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Visual Arts, Technology and Education:

How can teaching and learning in high school visual arts classrooms be enriched by the use of computer technology?

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Each moment in history has its own form of artistic expression, one that reflects the political climate, the intellectual concerns and the taste of the period. Taste is not an inexplicable whim. It is the product of well-defined conditions that characterise the social structure at each stage of its evolution.

(Freund 1982:3)

ABSTRACT

Whilst a variety of studies has appeared over the last decade addressing the gap between the potential promised by computers and the reality experienced in the classroom by teachers and students, few have specifically addressed the situation as it pertains to the visual arts classroom. The aim of this study was to explore the reality of the classroom use of computers for three visual arts highschool teachers and determine how computer technology might enrich visual arts teaching and learning. An action research approach was employed to enable the researcher to understand the situation from the teachers' points of view while contributing to their professional practice.

The wider social context surrounding this study is characterised by an increase in visual communications brought about by rapid advances in computer technology. The powerful combination of visual imagery and computer technology is illustrated by continuing developments in the print, film and television industries. In particular, the recent growth of interactive multimedia epitomises this combination and is significant to this study as it represents a new form of publishing of great interest to educators and artists alike. In this social context, visual arts education has a significant role to play. By cultivating a critical awareness of the implications of technology use and promoting a creative approach to the application of computer technology within the visual arts, visual arts education is in a position to provide an essential service to students who

will leave high school to participate in a visual information age as both consumers and producers.

However, the importance of the relationship between visual arts education and the visual information age in which we live stands in direct contrast to the low status attributed to the visual arts by parents, students, staff and administrators within the high school environment. Successful computer implementation and the use of interactive multimedia is impeded by this situation together with the many other difficulties facing classroom teachers in their efforts to use computers effectively. These difficulties include insufficient professional development, poor advice concerning curriculum integration and lack of technical support.

This study found that computer technology has the potential to enrich visual arts education in a wide variety of curriculum areas. Computer technology offers both a means of extending traditional media and a new medium for creative exploration as well as a resource for teaching and learning in art history, studio practice, aesthetics and criticism. However, in order for the participants in this study to take full advantage of these possibilities, further professional development and funding is required.

In particular, the study found that professional development experiences need to be placed within the broader context of the full range of activities suitable for enriching visual

arts education while taking into account the individual circumstances of each teacher in order to offer realistic and achievable goals suited to their level of development, available technology and special interests. Briefly put, visual arts teachers need a way to assess quickly their current position in relation to the use of technology in order to know where they are going.

The study recommends that resources should be designed for the visual arts classroom that promote a more realistic approach to computer implementation. Such materials should, firstly, present an enlightened and long term view of the integration of computers across all areas of the visual arts curriculum and secondly, demonstrate logical and incremental steps to guide teachers as they work towards that goal. Sources of funding are needed to provide these resources for the visual arts as well as much needed technical support, equipment updates and other commercially prepared resources such as interactive multimedia CD-ROM titles. It is also considered appropriate that computer networks be established between art teachers to encourage the sharing of successful classroom strategies and ideas while modelling the use of computer networks to students. In order to achieve these aims, the wider school community needs to recognise the relevance and value of visual arts education to contemporary society and to students in an age of visual information.

KEYWORDS

Visual arts education; Computer implementation; Professional development; Interactive multimedia.

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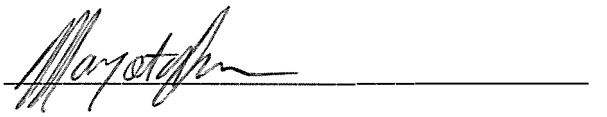
STATEMENT OF ORIGINAL OWNERSHIP

The work contained in this thesis has not been previously submitted for a degree or diploma at other higher education institutions. To the best of my knowledge and belief, the thesis contains no material previously submitted or written by another person except where due reference is made.

Signed:  Date: 3·8·95

Chapter One Introduction

Thesis Outline

Chapter One begins with an account, written in the first person, of those aspects of the researcher's personal background that influenced the emergence of the focus question: "How may teaching and learning in the visual arts be enriched by the use of available computer technology?". The study context, as highlighted by the literature review, precedes a full statement of the problem focus and its six contributing questions. A discussion then follows of how the chosen research method, action research, helped to answer the focus question. Statements of the study's limitations, findings and significance and a summary of Chapter One closes the Introduction.

In Chapter Two, the Literature Review adds to the understanding of the study contexts presented in the Introduction and raises issues of importance to the thesis topic. The literature review forms an integral part of the research cycle and becomes itself a source of data. Chapter Three, the Methodology, presents the seven stages of action and reflection which constituted the action research cycle. Findings are presented in Chapter Four in the form of three case studies and an analysis follows in Chapter Five. Chapter Six, the Discussion and Conclusion then closes the thesis.

Personal Background

As a high school student in the 1970s, art, to me, was the subject for people with ideas; it was a place to express myself without restriction. To others in my sphere, art had some cultural importance if a traditional approach were taken but since it frequently became associated with radical elements, artistic talent was considered a mixed blessing. Art was not as important to the school community as more academic subjects and did not offer the glory of sport. Coupled with the consensus that career prospects were tenuous at best, general approval for the subject

area usually only accrued through association with the school musical where art students' labour was invaluable for set preparation. Still, somehow, art was the only place I felt at home. I pursued a tertiary level study of fine arts that, for me, opened a door to a different way of knowing and has since served as my guide and inspiration.

During the compulsory period of no career prospects that followed my involvement in fine arts and preceded my involvement in education, I encountered my first visual arts computer. I am using the term visual arts computer to refer to a personal computer that meets specific hardware requirements that enables it to process visual images. It was 1986 and the Amiga Commodore had recently been introduced to the Australian market as one of the first, affordable, personal computers capable of producing high quality visual images. The Amiga was also capable of developing animations and working with sound. In the audio-visual communications industry, in which this encounter took place, both my colleagues and I were amazed by the potential of the technology and excited by its possible applications to the industry.

Five years later, I again found myself in the position to be amazed by the potential of such technology and excited by its possible applications, except this time the industry was Education. The Amiga Commodore had become less expensive; image processing software had become much more sophisticated and other computer platforms, such as IBM and Macintosh, had also moved towards making computer technology more accessible to visual artists and the noncorporate user. I found myself not only entranced by the ability to develop complex and fascinating images on the computer, but also by the possibility of presenting a sequence of visual images, together with sound effects and music, interactively.

Working with 'interactivity' added a whole new dimension to my experiences as an educator, artist and viewer. I found myself, a novice user, able to create a program that allowed viewers to change the direction of the presentation, respond to questions and receive feedback in a myriad of ingenious ways limited only by my imagination and my capacity to solve problems. A new realm of artistic and educational exploration became available to me and challenged me to think about the role of

computers in our society and the role of artists in the development of this new medium for creative expression known as interactive multimedia.

As a medium of expression, interactive multimedia technology is not out of reach of the average school. The Amiga Commodore I had been working with was the same computer that had been purchased for many high school visual arts classrooms across the country in the mid to late 1980s. A variety of image processing software was purchased with the computer and it came with built in sound, music and speech simulation capabilities. The software I was using to create an interactive multimedia presentation was reasonably priced and had been included free with many of the computers purchased for schools. With all this available technology, I was intrigued to find out how art teachers could apply it to classroom practice for the enrichment of visual arts education.

The Study Context

Classroom learning does not take place in isolation but is influenced by the context in which it occurs (Bresler, 1994). The

study discussed in this thesis, which takes place in three Brisbane high school visual arts classrooms, is nested within a broader context. That broader context has been divided into three areas for the purposes of discussion: information age society, educational institutions in the information age and visual arts education as summarised in **Diagram 1.** A contrast is revealed between the growing significance of visual imagery to contemporary society (Davies, 1991; Hinkson, 1991) and the low value placed on visual arts education within the school setting (Chapman, 1982; Zimmerman, 1994).

1. Information age society features an increase in visual communications and a trend towards globalisation.

At the broadest level, this study is influenced by its place in an information age society. The term 'information age society' is used to describe a society where more than 40% of the labour force is engaged in information industries. The term applies to Australia, the USA, Canada, Britain, France, Sweden, Germany and Japan (Jones, 1991). Within these social settings emerge two significant themes of relevance to this study: information increase and the influence of globalisation.

Study Context Summary

Diagram 1

This study is directly influenced by specific issues which thread through the broader contexts of society and school to find their focus in the visual arts classroom.

Information Age Society

- Increase in visual information highlights the need for visual arts skills and understandings.

- Trends towards globalisation reflect a growing acceptance of right brain, artistic qualities.

- Advances in technology offer new areas of exploration for artists such as interactive multimedia and Internet dissemination of artworks and critique.

- Australia's first national cultural policy responds to threats of cultural homogenisation through global communications by supporting local artists and technology based enterprises.

Educational Institutions

- Rapid developments in technology are emphasising concerns about the appropriateness of educational institutions, their structure, content and location.

- Educational commentators are beginning to acknowledge the impact of image-based media on students.

- Schools need to accept responsibility for teaching about the cultural impact of technology as well as just the practical concerns of how to use it.

Visual Arts Education

- Offers important skills for students living in an information age. Traditionally it is an area which encourages visual understandings, creative expression, social reflection and self reflection.

- Generally has a low status among school staff, adminstrators, students and the wider school community.

- Considered as a dumping ground for disruptive or less academically inclined students.

Inside the Visual Arts Classroom

Focus Question:

How may teaching and learning in the high school visual arts classroom be enriched by the application of available computer technology?

A. Increases in information, particularly visual information, highlight the importance of the visual arts and visual arts education to contemporary society.

In this discussion, the term 'information' refers to a wide variety of media products which may include textual, audio and visual information without implying judgements as to their quality, relevance or necessity. Increase refers not only to the circulation of increasing quantities of information but to an increase in the types of information available and the manner in which they are accessed.

Measuring the exact quantity of information circulating within the social landscape is an almost impossible task, however, many seemingly outrageous estimates have been put forward. For example, Lauda (1994) claims that United States high school seniors will be introduced to more information in one year than their grandparents were in a lifetime and that technical knowledge will double every 3-6 years throughout their working life. Sandom (1994) claims that 5,000 pieces of advertising information bombard the average American each day but that less than 2% of those advertisements register and even fewer are remembered.

Establishing the growth of information appliances is perhaps another way to gauge information increase. For example, fax machines were numbered fewer than 300,000 in the United States in 1985 but had reached 5 million by 1990 (Lauda, 1994). It is estimated that over 60 million personal computers will be distributed in America in 1994 (Sandom, 1994) and across the world, the number of CD-ROM players is expected to reach 45 million by 1996 (Commonwealth Government, 1994).

Of particular interest to this study is that much of the growth in the number of information appliances and the increase of information resulting is of a visual nature. Since the invention of the camera around the1840s and the consequent developments of film, television and digital imaging, visual information has become prolific. Davies (1991) describes society as experiencing an 'explosion of pictures' and notes the importance of visual imagery to a wide variety of fields outside the visual arts such as astronomy, engineering, chemistry, medicine and biology. Williams (1990) also notes the recognition of the importance of visual thinking to these professions. Duncum (1993) claims that contemporary society is exposed to more visual images than any

other people in human history. The high profile of visual images in every aspect of human life has led Hinkson (1991) to suggest that image-mediated consumption is the key mechanism for social integration within our culture. In the current information age, Hicks (1993) calls for a 'renewed consciousness' about the importance of visual imagery and the need for educating people to read and understand the subsurface meanings and allusions of visual communications. He suggests that people able to demonstrate art knowledge and skills will be highly favoured by the workplace of the future.

Another feature of the information age of importance to this study is the development of new ways in which information, including image-based media, is accessed. Interactive access or 'interactivity' refers to a mode of access in which users are able to create their own path through a base of information, customising the presentation sequence to suit their individual needs. Interactive multimedia CD-ROMs, public computer kiosks and interactive television are examples of technological developments which allow both more visual and more interactive modes of access. They are important to this study because they present new

areas for creative exploration and experimentation by artists. Wilson (1990) suggests that the unusual applications and innovations that results from the involvement of artists in new media often benefit mainstream developers and contribute to more creative uses of technology. The popularity of more visual and more interactive modes of access is evidenced by the recent and rapid growth of the multimedia industry both in Australia and overseas.

However, while a great deal of excitement accompanies the invention of new ways to communicate and access information, it is prudent to remain aware that rapid growth in information technology does not necessarily mean rapid improvements for society. The experience of information overload is raising the questions of quality and necessity among information users (Yelland, 1994a). Murdock (1992:37) states:

> Multiplicity does not guarantee diversity. More does not always mean different. It can equally well mean more of the same or the same basic cultural form being circulated in a variety of markets and packages.

Murdock notes that this lack of diversity indicates that information technologies are being dominated by major players who are not necessarily representative of the wide variety of minority groups and interests constituting contemporary society. Olson (1987) also comments on the likelihood of major players continuing to build their strength with new technologies at the expense of newcomers. Equality of access to information technologies is not guaranteed to all members of the community and this may result in a widening of the gap between social classes and between first and third world countries (Olson, 1987). These negative trends highlight the need for greater awareness and participation by all in deciding the future direction of technological developments.

B. A theme of globalisation is becoming apparent among communications, economics and political activities as well as in trends of thinking and problem solving.

The second outstanding feature of information age society, relevant to this study, is the evolution of global consciousness summarised in **Diagram 2**.

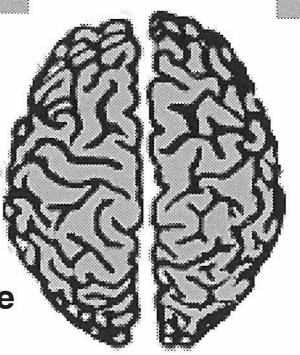
Diagram 2

Information Age Trends Reflect a Move Towards a More Right Brained, Artistic Approach.

Scientific, Linear Reasoning	Intuition, fuzzy logic
Exploitation Model: Local Interests at the Expense of the Global	Holistic Model: Sense of Global Responsibility, Environmental Movement
Dominance of Patriarchal Systems	Emergence of Feminist Movement
Top Down Business Structures & Management Models	Collaborative, Decentralized Management Styles
Teacher as Knowledge Giver	Teacher as Knowledge Facilitator
Text Based Media	Visual and Multimedia
Sequential Access to Media	Interactive Access to Media
Linear Space and Time	Space/Time Distortions through New Technologies
Quantitative Research	Qualitative Research

Left Brain Characteristics

linear
analytic
reason
conquering
rational
verbal
temporal
masculine



Right Brain Characteristics

intuitive
non-verbal
non-temporal
feminine
non-linear
synthetic
emotion
nurturing

The term 'global consciousness' refers to a mindset that has two main characteristics. Firstly, an awareness of events on a global scale and secondly, the acceptance and application of more global approaches to thinking and problem solving. These two characteristics are relevant to this study because they may present a more global audience for the dissemination of art works and create an appreciation of a more artistic style of thinking.

Media technologies, enhanced by the use of communications satellites, have contributed to a global exchange of information which enables images and commentary on foreign locations and events to be delivered to the home. Consciousness of world events, such as the Gulf war (1990), the change from white rule in South Africa (1994) and the destruction of the Amazon rain forests (1960s-1990s), for example, have thus become common place experiences. Global linking through technology has made long distance communication in a variety of media almost immediate and so encouraged an interconnectedness between distant locations, unique to our times. The growth of this trend is evidenced by the rapid rise of the networked personal computer. Button (1993:53) states that at that time, the Internet, or

international information network, allowed approximately 20 million people from 125 countries around the world to communicate instantly through electronic mail. He estimated that Australia had about 400,000 people on the Internet; 300,000 more than in 1991 - a growth rate that could lead to "everyone on the planet being on the Internet by early next century." This trend indicates a significant change in communication patterns towards globalisation.

Global economics, accentuated by the growth in world wide information exchange, focuses attention on the potential impact of a global marketplace on both the cultural and financial wealth of each country. Creative Nation (Commonwealth Government,1994:4) represents the first national cultural policy in Australian history and as such is a significant shift in attention towards artistic and cultural products as economically important commodities for the global marketplace. The policy declares that Australia is at a critical moment in history due to the speed of global, economic and technological change and acknowledges the threat of cultural homogenisation:

> Many Australians say that just now Australian culture is under unprecedented threat. The revolution of information technology and the wave of global mass culture potentially threatens that which is distinctly our own. (Commowealth Government, 1994:4)

The fear of a loss of Australian cultural identity and the potential for economic growth through image-based information technologies has led to a recognition of the value of local creative products and a realisation of the necessity for creating cultural policy at a federal level. The Creative Nation policy recommends a commitment to a charter of cultural rights that guarantees "the right to an education that develops individual creativity and appreciation for the creativity of others" (Commonwealth Government,1994:2).

Another facet of the trend towards global consciousness is found in the popularisation of styles of thinking and problem solving that acknowledge and synthesise theories about the functioning of the artistic, right hemisphere of the human brain. The qualities of non-linear, divergent, feminine, nurturing and imaginative thinking, usually characteristic of an artistic approach and identified as right brain activity (Bogen,1975; Sperry, 1968),

are becoming more highly valued as traditional left brain approaches fail to meet the demanding problems of our time. A more holistic, global approach is becoming a common feature in business, educational and health strategies where the development of creative thinking skills and visualisation are considered important (Agor, 1986; Agor,1989; De Bono, 1976; De Bono, 1975; Harman, 1988; McKim, 1980; McPeck, 1981; Sommer, 1978; Resnick, 1987; Von Oeck, 1983).

The growing interest in qualitative research over the past decade with its cyclic, holistic approach and interest in the recording of feelings and attitudes also reflects a shift away from the more sequential, linear, numerical and positivist approaches of quantitative research which indicate a left-brain dominated thinking style. Eisner (1993:54) notes that one of the most important outcomes of the emergence of qualitative research paradigms is that indirectly, "a climate is being created in which the educational value of the arts can be recognised".

In summary, the context of an information society featuring increases in visual information and globalisation is

important to the visual arts and visual arts education in a number of ways:

i) The information age has led to a recognition of the potential for economic growth in a global marketplace through the combination of artistic enterprise and information technologies. This has resulted in the creation of the first national cultural policy in Australian history.

ii) Local, cultural products and expressions of originality have become more highly valued as global communications and information industry monopolies have a homogenising effect on the uniqueness of places and people.

iii) An increase in visual information creates a demand for people who are skilled in creating visual communications and emphasises the need for a viewing public that is critically aware of the communications it is receiving.

iv) A wider audience for art works results from the increasing use of reproduction and communication technologies such as the printing press, film and television, interactive multimedia and the networked

personal computer, requiring artists to be aware of new media for expression and dissemination.

v) The use of visual imaging technologies and visual approaches to thinking and problem solving in many industries outside the visual arts area may be beginning to create a wider appreciation of the value of artists and artistic approaches.

vi) Questions raised by the advancement of technology regarding its direction and impact supply rich subject matter for much needed critical comment and expression by the artistic community and art related industries.

2. Educational institutions in the information age: Restructuring and acknowledgment of the impact of image-based media.

Educational institutions in general constitute the second broad context influencing classroom teaching and learning in the visual arts. Information age technologies, image-based technologies, global communications, associated economic trends and ensuing social concerns are creating changes to every aspect of educational institutions.

Bigum and Green (1993) suggest that the relevance of content, the role of teachers and even the architectural space of classrooms are being reconsidered in the light of technological possibilities and the needs of a changing society. They assert that the current school model, based on the industrial revolution, is no longer appropriate in an age of technological revolution. The promise of technology to make vast quantities of information instantly available and continually updated may change the role of the teacher from that of a giver of knowledge to that of a facilitator of access to knowledge (Ambron, 1990; Bigum and Green,1993; Yelland, 1994b). They suggest that even the interior of classroom space may be radically altered from its current factory based appearance to one which more readily reflects liberation from print based media and alignment with new found abilities to communicate.

This fundamental questioning of the nature and place of learning is creating lively discussion amongst educators. Some commentators, such as Perelman (1988), see educational institutions as being at risk of becoming irrelevant through their inability to keep pace with changes in information and

communication technologies. McClaren (1985) notes that other educators disagree by recalling how past technological innovations, such as television and film projectors have failed to make any significant change to the functioning of schools. McClaren suggests that this argument is somewhat shallow, however, and points out that while it is true that televisions and film projectors have neither replaced teachers nor been used to great advantage, they have had a major impact on schools by changing the students who attend them. Joost (1985) applies this same observation to the use of computers and information technology, commenting that the force of the impact on schools and education is likely to come from the changing cultural context in which schools find themselves.

The highly visual nature of new communication technologies has meant that some educators are acknowledging the profound influence of image-based technologies, such as magazines, televisions and computer games on students both in and out of school hours. Hinkson (1991) comments on the impact on education resulting from the shift from written word to image, suggesting that a social space constituted by the information and image revolution will clearly lead to major transformations within

education. Duncum (1993) suggests that the challenge to education today is universal visual literacy and Slawson (1993:21) suggests that:

> The ability to compose meaningful images, video and sound is as important as the ability to compose communicative text.

Another key issue creating concern among educators is the neglect by teachers of the wider responsibilities associated with the use of computers (Bigum and Green, 1993; Munoz, 1993). Bigum and Green (1993) urge teachers to consider more than just the practical and day-to-day concerns of technology use. They put forward an environmentalist approach of 'acting locally but thinking globally' in order to encourage the broadest possible view of technology use, placing it in a more global, moral and ethical context.

Bigum and Green (1993:15) suggest that:

> Teachers' use of computers inextricably ties them to the things that computers have spawned outside the classroom. We believe that to ignore these wider cultural and social shifts is educationally irresponsible.

In summary, the situation in which educational institutions find themselves in an information age are meaningful to this study in the following ways.

i) Educational commentators are becoming aware of the increasingly visual nature of communications influencing students outside the school and their impact on student learning and social integration. The visual arts might provide one place to start exploring more appropriate uses of image-based media in education.

ii) All educators, including those working in the visual arts, need to broaden their interest in the use of information age technology from merely local and practical concerns to an awareness of the global and social consequences of the uses of technology.

3. <u>The visual arts subject area holds a low status within the school and its community</u>.

The third and closest context to this study's focus is the visual arts subject area. The visual arts have traditionally held a low status within school settings that have promoted literacy,

numeracy and the sciences as the areas most important for Australia's future.

Laura Chapman in her book, "Instant Art, Instant Culture: The Unspoken Policy for American Schools" (1982), presents a thorough account of the problem of the status of visual arts education. The fact that the situation she describes has improved little over the past decade is highlighted in a more recent study by Zimmerman (1994: 79), who reports that while there are extreme variations in how the visual arts are represented in schools :

> Art education generally is held in low esteem and art classes often are associated with entertainment and play, and the amount of time given to art study is minimal at best.

Other authors such as Eisner (1993), Gehlbach (1990) and Munoz (1993) make passing comments which indicate their belief that the value of visual arts education remains unrecognised. In-depth studies or accounts similar to that of Chapman in the United States are not as well represented in Australian literature. However, Australian visual arts education is comparable to the situations Chapman describes.

Chapman's study reveals that the low status of arts education is deeply ingrained within school culture. General misconceptions about the study of art characterise the thinking of teaching staff, school administrators and students along with the wider school community. One way Chapman (1982:29) illustrates this is through the analysis of familiar comments about artistic activities. For example, comments such as "Art is play.", she suggests, really contains the message that art is never work and doesn't require disciplined study. "I don't need to know anything about art to know what I like" gives the demeaning idea that a knowledge of art doesn't aid judgement. "If you have to explain it, it isn't art" translates to the short sighted view that art is self-evident and can't be illuminated by explanation. The comment "Art is anything you can get away with" puts forward the idea that there are no criteria for judging art. Collectively, these represent a common, demeaning view of the practice of art and art education.

Unfortunately, it is attitudes such as these which inform the decisions of school counsellors and administrators who consider art to be a 'soft' option, particularly suited to non-academic students and disruptive personalities (Chapman, 1982).

These attitudes underlie the decision that Art should not be a compulsory part of the curriculum or even offered as an elective at some schools and they reinforce student decisions not to enrol in Art. Chapman (1982:2) states:

> The message that many of our children get from current practices in schools is this: Art is a 'frill' unworthy of being included in the regular curriculum, and hence of marginal importance in adult life.

The visual arts are not perceived as core skills like English or Mathematics and therefore miss out on funding opportunities, resource development and training initiatives. The visual arts are also missing from current debate about educational reforms related to curriculum, teaching methods and the evaluation of learning which focus mainly on English, Mathematics and Science and treat the arts as merely an extra or an enrichment activity (Chapman, 1982; Zimmerman, 1994).

In summary, issues related to visual arts education in Australia influence the study by highlighting the need for school administrators and policy makers to reconsider the value of visual

arts education to the lives of students and offer appropriate recognition and support to visual arts programs.

Summary of the study context

In summary, the cultural setting in which this study is located suggests that visual arts education has a significant contribution to make to students of the information age and highlights the need for studies in the area of technology and Art education. Four main factors contribute to an understanding of this need. Firstly, mass reproduction, global transmission and imaging technologies have broadened the sphere of influence of the visual arts making visual imagery an increasingly important form of cultural communication and offering new media for artistic exploration.

Secondly, the power of visual imagery and the application of artistic skills and understandings are beginning to be more widely appreciated by a broad range of industries and academic disciplines indicating the need for educators to recognise the important contribution of visual arts to the school and its

community. Thirdly, the business of art is being conducted on a world stage, highlighting the need to support local ideas and cultural products through acknowledging the contribution of the visual arts and visual arts education and fourthly, visual arts educators share the responsibility of all educators to contribute to shaping the future direction of technology and the preparation of students for their role as critically aware consumers and creators.

The Problem Focus

How may teaching and learning in high school visual arts classrooms be enriched by the use of available computer technology?

In the light of these concerns about technological change, education and the visual arts, the visual arts classroom itself provides one starting point for an exploration into how available technology may be used to enrich visual arts education. The following six questions contribute to this area of inquiry.

1. How do art teachers see computers enriching visual arts education?
2. What are art teachers currently doing with their available computer technology?
3. To which art curriculum areas are computers applied?
4. How have teachers adjusted to the presence of computer technology in their classrooms?
5. Which features, elements or issues occurring in the teaching environment are seen as helping or hindering the use of computers in the classrooms?
6. In what ways would the teachers most like to be helped in the use of computer technology in visual arts education?

Method Justification

The study reported here is based on the researcher's epistemological belief that people construct their own reality from personal experiences of a shared social context. Processes of construction are continual, making people infinitely capable of change and resulting in a complexity of variables that are difficult to measure quantitatively. Therefore, the researcher sought to study qualitatively the practices, points of view and social

contexts of the participating visual arts teachers in order to understand better how computers might enrich teaching and learning in visual arts classrooms.

Qualitative research, based on such a constructivist view of reality is an interprative and holistic approach to educational investigation highly favoured by the artistic community. Eisner (1993) suggests that qualitative inquiry epitomises what artists do in their creative work. He notes similarities between artistic practice and qualitative research such as an interest in the relationship between elements and an appreciation for the uniqueness of outcomes. Eisner also believes that artistic values are well served by the aesthetically crafted style of writing favoured by qualitative research which fosters empathetic experience and enhances understanding.

Whilst a variety of qualitative approaches are available to arts education researchers such as ethnography, phenomenography and case study, action research in particular, is noted for its ability to bridge the gap between theory and practice (Bresler, 1994). An action research approach allows the principle

investigator to play a key role in the research process, contributing practical expertise through participation rather than theoretical understandings (Bresler, 1994). In this respect, action research differs from other qualitative approaches in that theory is a secondary consideration whilst the immediate improvement of the practices of the participants is of primary importance (Bresler, 1994). Action research then, as defined by Kemmis (1994), is both participatory and collaborative, and aims at the improvement of social and educational understandings, practices and settings by involving those affected in the change process.

Researchers interested in the implementation of computers in educational settings also note the importance of the change process and the personal concerns of the individuals involved. The view that change only occurs as individuals change (Cicchelli & Baecher, 1989) implies that successful implementation of innovations are directly linked to the attention given to the personal concerns of participants and the level of their involvement. Hadley (1993) considers that integration of computer technology is a local phenomenon and therefore the varying features of the individual contexts under question are highly

influential to successful integration. Campbell (1991), however, notes that, to the contrary, existing studies of technology use in art education have rarely discussed the teacher's role in implementation and Ettinger (1988) calls on art educators to offer their own perspectives.

In view of the comments cited above, an action research methodology was considered appropriate to explore the problem focus of this study and its contributing questions, for three main reasons. Firstly, the methodology allowed the gaining of insight into the participants' points of view and approaches to computer use for the enrichment of visual arts education, complementing the researcher's epistemological beliefs. Secondly, the methodology took into account the researcher's desire to contribute to changes in the study situation in a collaborative way, directly linking research to action in response to the needs of the participants. Within the high school setting, the participating teachers, having the onerous responsibility of preparing students now for a world of work they will not enter for some years, were perceived by the researcher as being particularly in need of approaches which link up to date information and innovative strategies directly to

classroom practice. Thirdly, the methodology encourages disciplined self reflection which gives the researcher as an educator, the chance to reflect on her experiences, enriching personal understandings, conceptions and future practice in the field of Art and technology education.

Limitations

This study shares the strengths and limitations common to all qualitative research in that the findings are both context dependent and personally interpreted. As a result, the research findings are not easily transferred to situations beyond the scope of the study and comparison with other research is limited. In view of this possible limitation, the researcher has attempted to make clear and detailed descriptions of the characteristics of the study settings and participants for the purpose of enhancing comparability and translatability by helping readers to identify similarities between the study and their own circumstances (Bresler, 1993).

Significance

Action research is primarily significant to the participants directly involved in the research (Burns, 1994). Therefore, the study findings are of most significance to the collaborating teachers and the researcher, as Art and technology educators. However, while non-generalisability is typical of action research (Bresler, 1993), it is possible that other teachers may recognise themselves in this study, particularly to the extent that the classrooms involved were not overly endowed with technology nor the teachers with specialist training. The research may assist teachers in similar situations who seek to enrich art education through making better use of their classroom technology.

The study also provides insights useful to curriculum developers and providers of professional development who might draw on the experiences of classroom teachers in the design of support materials and inservice experiences related to computer technology. Freedman (1991) suggests that research conducted in the context of Art classrooms is very important to improving understandings about teachers' approaches to technology use.

The study also contributes to the body of knowledge existing in the general area of computer implementation in education. The results of the researcher's involvement with the study participants reflects the findings of other researchers such as Campbell (1991), Zammit (1992) and Cicchelli (1989) as well as contributing more specific details related to visual arts education. These details identify questions worthy of future research and highlight issues relevant to teacher preparation and inservice in the visual arts, the integration of computers within the arts curriculum and subject area advocacy.

Chapter One Summary

In summary, this study responded to the researcher's concern that the potentially important role computer technology could play in visual arts education was not being realised in the average classroom setting. The chapter used the broad context surrounding the study to emphasise the importance of both art and technology to contemporary society and a contrast was identified between this and the low status of visual arts education within the school community.

In response to this context, the problem focus was identified as exploring how teaching and learning in the high school visual arts classroom might be enriched by the application of available computer technology. An action research methodology was chosen for its ability to contribute to change in the study setting. The limitations of the study were recognised as low generalisability and it was noted that the study's findings would be of most significance to the researcher and the participants.

Chapter Two Literature Review

Chapter Two Outline

The literature review is divided into five sections beginning with a discussion of the historical relationship between visual arts and technology. Articles which discuss the use of technology in visual arts education are then reviewed followed by an examination of current research into the implementation of computers in educational settings. Literature which discusses the professional development of teachers, particularly in relation to the implementation of innovations, is then addressed.

The process of reviewing the literature was integral to the sequence of action and reflection involved in applying an action research methodology. The review was conducted continuously and was responsive to field experiences. In some instances, the literature influenced the direction of the research and formed part of the body of data.

Section 1: Visual Arts and Technology

The technological developments that have impacted on the visual arts throughout history are numerous. They include the paintbrush, the metal foundry, the *camera obscura*, the electric drill, the invention of plastic, the photocopier, the computerised lathe, satellite communications and laser light technology. Of these developments, the camera is perhaps most comparable to the phenomenon of the personal computer. Therefore, the literature reviewed in this section first discusses the social changes resulting from the widespread acceptance of photography and compares them with the current situation concerning computer technology.

A. The influence and acceptance of photography

Since the 1840s, the camera has been responsible for what Davies (1990:32) refers to as an 'explosion of pictures'. The pictures that constituted this explosion helped change society by immortalising the dead, improving scientific and medical practices, offering new ways to study people and places (Hockings,

1975) and contributing to a global culture. The camera has also changed our conception of reality by becoming a model for explaining vision. What was recorded through the 'eye' of the camera was taken as fact, a totally impartial documentation of what would have existed had the viewer actually been there (Freund, 1982).

The ability of the camera to produce realistic images presented a threat to artists of the 1800s, particularly portrait painters, whose reputation rested on their ability to achieve a likeness of their models. Freund (1982) notes that both the wealthy and the money-conscious came to prefer photographs which were economical and offered an exact record of the occasion, resulting in a loss of commissions for artists. Of course, some artists and critics were quick to suggest that a mechanically produced object such as a photograph could not possibly have anything in common with art (Freund, 1982).

While many traditional artists criticised the use of photography, others took advantage of the camera's ability to make accurate visual records and used photographs as an aid to memory

for studio work. Schwarz (1985) presents the 1860 photograph of the Prince and Princess Metternich, taken by Disderi, which was used by Degas painting "Portrait of a Woman" shown in **Illustration 1**. Gaugin, Toulouse-Lautrec and Rousseau are similarly recorded as having painted from photographs. The camera also had a significant effect on the direction of art as a point of departure. The German expressionist movement proclaimed that the camera had freed them from the 19th century preoccupation with exact representation (Schwarz, 1985). This sense of liberation from accurate depiction of the visible world was a significant factor in the development of the art movements of the late 20th century.

The communicative power of photographic images was further enhanced by improvements in the printing industry and the development of film and television. The combination of these technologies has resulted in wide distribution and reproduction of photographs and moving images and has created cultural communication for the masses. Indeed, it is through these reproduction and mass communication technologies that most of us are able to recognise artworks of historical and controversial

Examples of the Use of Photography in the Development of Art Works

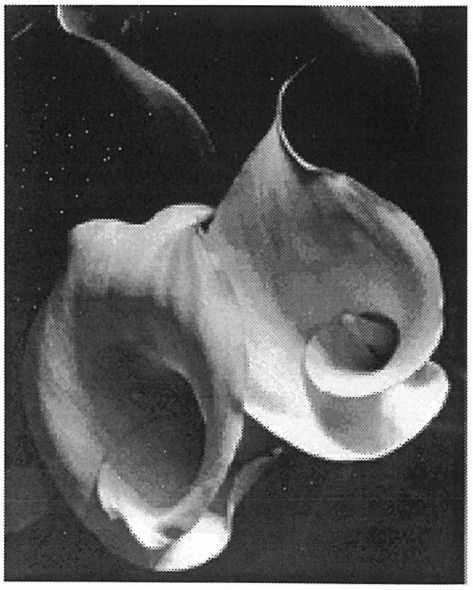
Illustration 1

Edgar Degas based his painting, below,, *Portrait of a Woman'*, (Tate Gallery, London) on the 1860 photograph, left, of the Prince and Princess Metternich by Eugene Disderi (Schwarz, 1985) .

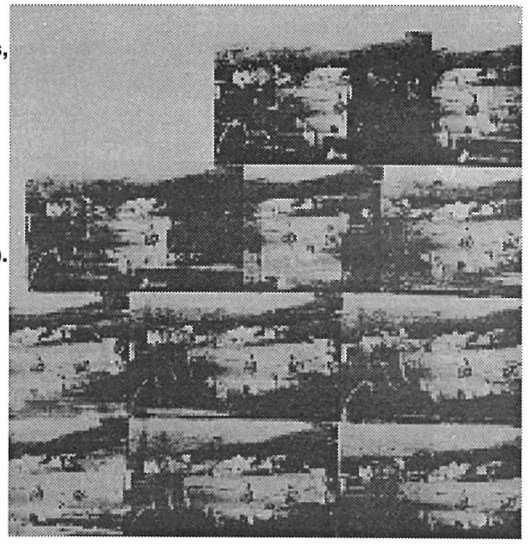
Henri de Toulouse-Lautrec based his painting, above, *'A la Mie'*(Museum of Fine Arts, Boston, Massachusetts) on Paul Sescau's 1890 photograph of the same subject, right (Schwarz, 1985).

Robert Frank's 1952 photograph, left, from the series *'The Lines of My Hand'* draws upon the ability of the medium of photography to remove an image from its context and open it to many possible interpretations (Lemagny et al.,1986).

Imogen Cunningham's 1929 photograph, below, *'Two Callas'* , is an example of photographic purism, one of the many forms of creative photography to be accepted now as fine art (Lemagny et al.,1986).



Warhol used photographic images, monochromatic special effects and contrasting background in his 1964 mixed media work, right, *'Orange Car Crash'* (Lemagny et al.,1986).



significance. Malraux (Freund, 1980:95) comments on the curious consequences of this phenomenon:

> Reproduction has created fictitious works of art by systematically falsifying scale and by presenting stamps of oriental seals and coins as if they were columns, or amulets as if they were statues.

The camera eventually became much more that just a tool for art reproduction and promotion and, after some struggle, has become an artistic medium in its own right. For example, the photographic works of Henri Cartier-Bresson, Margaret Bourke-White, Man Ray and David Hockney are internationally known and sought after by even the 'finest' of art galleries. In contrast to the view that photography is an impartial and factual account, their works show how the artist may influence a viewer's perception through the use of photographic techniques and manipulate meaning through the separation of images from their context as shown in **Illustration 1**. Man Ray and Hockney have shown, through their artistic works that the camera is something other than a model of human vision. Man Ray (Perl, 1988:10) suggests that "Photography

is a marvellous explorer of aspects that our retina will never register" and David Hockney (Sayag,1982:13) comments that:

> When you look through a camera, you are not photographing what you see in real life - real life has no edges and it is the edges that give the photograph life.

B. Similarities between the history of photography and that of computer developed art.

The impact of computer technology on the visual arts shares many similarities with the preceding discussion. Like the camera, the computer has contributed to the way we observe and interpret the world. The combination of visual imaging and computer technologies has influenced a wide range of disciplines such as medical diagnosis, prosthetics, air traffic control, space flight, weather prediction, telecommunications, audio visual recording and national security systems (O'Connell, 1993).

While the camera is sometimes thought of as a model of human vision, the computer is often considered a model of human thought (Roszak, 1986) and like photography, we are inclined to

take the processing of the computer to be factual and without bias. Roszak (1986:178) warns that:

> In our desire to be relieved of the confusion of our times, we have taken as absolute authority, computer processed information that is far from impartial and devalued other important aspects of thought and reasoning by believing in the computer as a model of human thought.

Williams (1990) takes the view that considering the computer as a model for human thought has led to the realisation of the particular ways in which human thought outperforms even the most sophisticated computers. She criticises educational institutions for being slow to value these other aspects of the human condition and for continuing to define human intelligence in terms of memory and computation. Just as the camera liberated artists from realistic depiction and contributed to the development of an appreciation for the abstract, perhaps the computer has the potential to develop an appreciation for qualities of the human mind other than mathematical logic.

The computer also shares with the camera, a difficult path to validation as an art form in its own right as the argument over whether a machine can create worthwhile creative expression, repeats itself. Hicks (1990:80) suggests that the rejection of technology is based on the perceived dichotomy between human and machine. He suggests that the common assumption is that "people make art, machines do not". Fisher (1993) reports a similar opinion, held by a prominent local design firm, that the computer is a reproduction tool not a design tool. In this firm, use of computer technology has been limited to administrative duties. Even the term 'computer generated' images gives the impression that a computer has created the image, not an artist. It would seem that the perception of computers as being strongly associated with mathematical computation, scientific reasoning and business stands in direct contrast to the traditionally spontaneous and intuitive approaches of artists.

Dery (1993:75) suggests that the computer poses a threat to artists similar to that of the camera 150 years ago. The computer, however, may prove to be more threatening. While both the computer and the camera can produce realistic images; the

computer's ability to copy digitally, endlessly reproduce, manipulate and combine images poses a copyright problem for the original owners of the images. Computer programs can mimic artistic styles, instantly rendering a photograph as an impressionistic or pointillistic painting and allowing the user control of simulated paint thickness and simulated canvas textures (Painter, 1990). Brown (1990:197) fears that the future will be "typified by a high volume of visual pollution" due to the ease with which anyone using computer technology can get involved in image making.

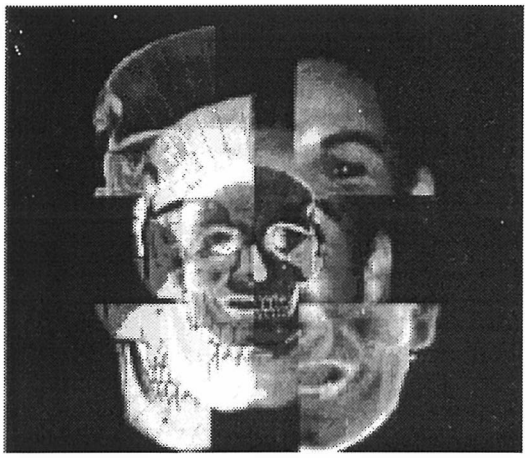
As with the camera, the computer can be used both to assist in the creation of art works and as an art form itself. Fabric design, architectural design and screen printing, for example, can all be enriched by the use of computer technology in the design process (Hammond, 1993; O'Connell, 1993). The computer can also be used as a compositional tool and problem solving device for sculpture and painting (Hubbard and Greh, 1991). For some artists, however, technology has become the main form of both the creation and presentation of their artworks as shown in **Illustration 2**. Screen output from the computer or framed laser

prints are displayed in art galleries (Dery, 1993) alongside more traditional works. However, a frequent criticism of the new genre of computer generated art is that is doesn't look original and is more about the special effects of the technology than the artistic content (Burson, 1993). More adventurous artists such as those shown in the bottom half of **Illustration 2** are moving beyond the gallery system to explore new formats for the dissemination of their work such as the Internet, public installations and interactive multimedia as shown in Veeder (1988) and McKay (1994).

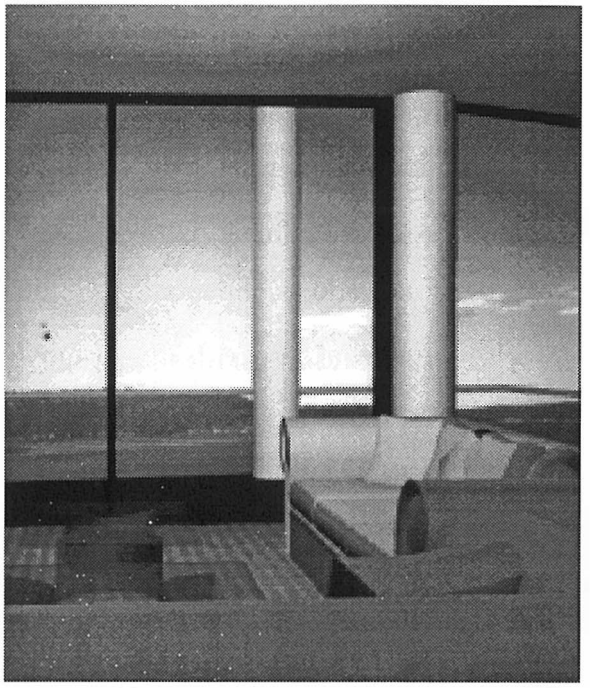
Wilson (1990) describes six interactive art installations which take art out of the gallery environment and deliver it to audiences in a way that encourages participation and co-creation. The locations of these installations varies from the lobby of the San Francisco City Hall, where an interactive computer sculpture mimicked the behaviour of civil servants, to a computer show where audience members participated in a debate between computers with synthesised speech and voice recognition capabilities. Other computer artworks were delivered over a cable TV channel where viewers were encouraged to change the direction

Examples of the Use of Computers in the Development of Art Works

Illustration 2

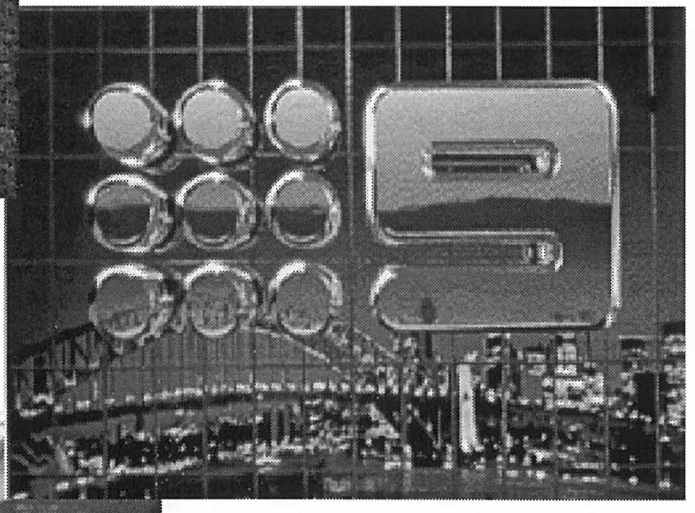


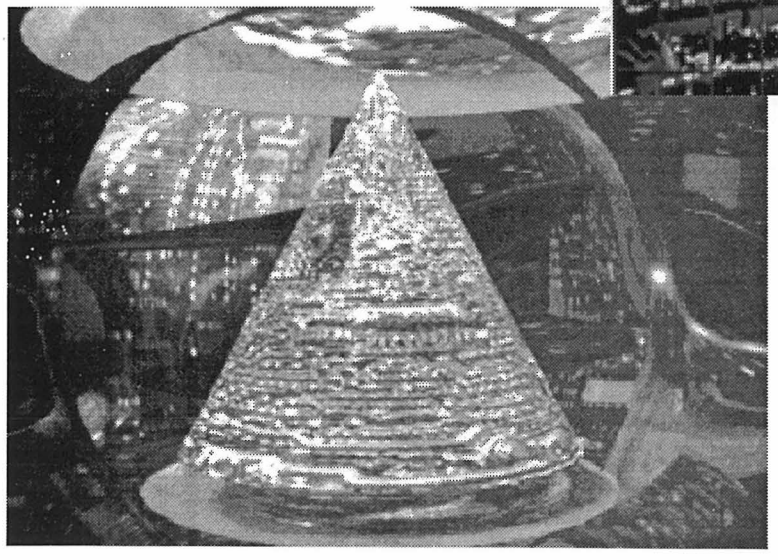
Scanning and image editing software are frequently used in the creation of fine artworks such as the student work, above, by Darren D'Cruz (Ryan, 1993).



Images developed with 3d modelling packages are used by architectural and interior design firms to help clients visualise end results, above (Computer Artist, 1993).

Stephen Wilson's installation, above, *'Ocean Merge'* (1990), combines the computer with the natural environment to create a new display format for computer based artwork.





3d animation and special effects are becoming common place in film and television such as the above 1992 Logo for Channel Nine (Computer Artist, 1993).

Faye Maxwell won the 1994 Australian National Digital Art Awards with a screen based artwork 'Networld', a still from which is pictured at left (Murray, 1994).

of the performance by phoning in responses. A beach provided another unusual location for a computer installation where an Apple computer displayed images and played sounds that were controlled by the pressure of ocean waves on metal rods linked to the game ports of the computer. Wilson (1990) comments that computer art is usually associated with high-tech, urban environments but that great opportunities await artists who are willing to combine nature and technology in non-traditional settings.

Wilson's (1990: 262) attempts to inspire participation and co-creation is a reaction to his belief that through exposure to common media experiences, human consciousness is being shaped in a way which negates diversity of perspective, individual activity and initiative. He states that:

> Art presented in the traditional way to an audience of passive spectators reinforces the dangerous idea that people should accept what is offered.

He believes that artistic exploration of interactive forms has the potential to lead the way in other areas of public life such

as education, politics, commerce and entertainment and emphasises the need for art to serve that purpose now more than ever.

For visual artists, an important aspect of working with new technologies is the need to collaborate with others. Multimedia computer works, in particular, may require a team of skilled individuals such as musicians, programmers, cinematographers or actors. Visual artists who have traditionally worked alone will need to acquire new interpersonal skills; a point that does not go unnoticed by the Commonwealth Cultural Policy (1994:60). The policy refers to this problem as "a major impediment to the development of a successful multi-media industry".

The final similarities between the camera and computer is their close link with the development of mass communications and their influence on popular culture. Dery (1993) suggests that computers and art are converging in everyday life based on the frequent use of computer animation in commercials such as Listerine's "Plaque Buster", animated television network logos

and movie special effects. He also discusses the popularity of new ways to store digitally, access and disseminate creative works. Dery (1993) reports that businesses involved in visual arts are taking advantage of the capacity of computers to offer interactive access to vast collections of visual images. He discusses computerised fine art sales systems in place in Arizona and monitoring systems used by art auctioneers which record global transactions and present high resolution images of the works in question.

A cautionary note is offered by Brown (1990) who considers the comparison between the economic climate surrounding the development of photography and that surrounding the emergence of computer generated imaging. Photography, he notes, developed in a time of economic confidence, exploration and growth and stands in contrast to the recession and instability of the 1990s which serves to inhibit the full creative potential of computer use. He suggests that owners of computer technology are pressured to produce and not to play and identifies approaches that focus purely on economic return as serious problems for the future of design this decade.

Summary of Section 1

The literature reviewed in this section has shown that the history of visual arts and technology reveals a not always amicable relationship. Art and technology, to some, are opposing concepts that combine to create poor substitutes for more traditional media and methods and threaten to devalue originality and skill. Nevertheless, computer technology in particular, continues to influence all aspects of the visual arts industry. Galleries, museums, art dealers, auctioneers, buyers, publishers and art practitioners from all art disciplines have found ways to take advantage of the digital revolution.

Massive storage capacities, interactive access, manipulation and electronic transmission of visual images have provided artists with new ways to create and disseminate artworks. The literature shows that interactivity, in particular, offers a new area for exploration which challenges the relationship between viewers and artworks and calls for structural changes to the traditional presentation of art. Change is also indicated in the working relationships between artists from that of solo producers

of artworks to more collaborative, team based approaches. Several reports highlight the potential of artistic involvement in new technologies to develop economically viable industries for Australia and to serve the community at large by pushing the boundaries of our perceptions about the possible applications of computers. However, a warning is issued to those who focus solely on the economic returns of computer applications at the expense of creativity. Such attitudes threaten to inhibit exploration and innovation at a time when they are most needed.

Section 2: Visual Arts Education and Technology

Of significance to the focus of this study is the subject area of visual arts education. The literature reviewed under this heading is organised to discuss, firstly, curriculum issues within visual arts education and secondly, applications of technology to the visual arts curriculum.

A. Issues within the visual arts curriculum

A major underlying issue for visual arts educators is that of the low status of visual arts education within the school system, already referred to in Chapter One. In part, this situation has been due to problems within the visual arts curriculum itself which has led to a misunderstanding of the purpose and value of visual arts education.

Chapman (1982) suggests that one of the reasons for the devaluing of art education is that art programs in schools traditionally concentrate on the production of artworks and therefore give the impression that the purpose of art education is to train art practitioners. She questions persisting in this vein since few adults actually go on to become professional artists. A good art program, Chapman suggests, is more than just craft projects and the occasional visit to the gallery. It acknowledges the value of visual expression evident in every human endeavour and benefits not only those students whose intention is to become artists, but those who may go on to work in many art related industries. Hicks (1993) suggests that all members of

contemporary society need to be educated to understand the subtle meanings of visual communications which surround them everyday.

The vision of the ideal art curriculum is often not realised by art teachers who find themselves relatively free to invent the curriculum (Chapman, 1982) and who rely on their specialist interests to compensate for a narrow approach to art education. Chapman (1982:11) states:

> Indeed, quite a few teachers have been urged to adopt a 'personal' philosophy of art education as if intensity of one's personal preferences offered a proper and complete justification of educational practice.

The emergence of discipline-based art education in America in the early 1980s sought in part to address this problem of an imbalanced curriculum through an approach to art education which drew on content from four main art disciplines (Dobbs, 1988). As Eisner (1988:17) suggests:

> There are four things people do with art. They make it. They look at it. They understand its place in culture over time. They make judgements about its quality. In discipline-based art education, these four operations constitute art production, art criticism, art history and aesthetics (Eisner, 1988:17).

Queensland educators, in general, support this broadened approach to art education. Leo (1993:3) confirms the view that the subject area of art and design encompasses not only the design arts and fine arts but folk arts, popular arts, community arts, information arts and arts industry studies and advocates that these are "integral to important life opportunities". Duncum (1993:15) also writes about a non-elitist, broadened approach to the arts and states that:

> Their value lies not so much in the reasons why some categories of visual art are privileged, but rather in the fact that as a whole they are such an ordinary part of life.

However, these views are not necessarily reflected in classroom practice where Hammond (1993:4) notes that:

> Art, at a high school level, has not yet shaken its purist or traditionally western attitudes to art. Perpetuated are the 'composition design' values and a eurocentric perception of art history (Hammond, 1993:4).

In response to this situation, the subject association for visual arts education in Queensland continually lobbies for better recognition and support for visual arts education. They insist on the importance of appropriate professional development for visual arts teachers and advocate multi-cultural approaches to art education and the incorporation of computer technology in teaching practices (Leo, 1993).

However, the National Curriculum and Profiles defines the arts as not only the already diverse area of art and design but also includes Dance, Music, Media and Drama under the same heading causing concern among visual arts supporters who consider that their area may warrant separate funding considerations (Leo, 1993). According to Leo, the visual arts services more than fifty percent of all students enrolled in visual and performing arts in secondary schools. The prominence of visual arts is also reflected

in the Commonwealth Cultural Policy (1994:7) which tables persons working in the visual arts and crafts to be more than double (approximately 600 000) those working in the areas of media, music, performing arts, film and television, writing and publishing and collecting institutions who each numbered less than 300 000. Farwell (1993:8) suggests that if the arts compete for funding, however, the results will be suicidal and recommends instead the development of positive working relationships between the various arts disciplines.

The eight key competencies recommended by the Australian Education Council (1992) which support the National Curriculum do not specifically recognise the arts and creativity. This may seem surprising considering the value recently placed on the arts and creativity by the Commonwealth Cultural Policy (1994). Under these circumstances, Farwell (1993:8) urges art educators to identify clearly where their classroom practices are able to generate the listed competencies in order to justify the inclusion of the arts within the school environment and gain funding. This is a problematic situation for those involved in encouraging creativity because, as Crittenden (1994) suggests, the

outcomes of such activities are often intangible, difficult to predict and awkward to assess. The competencies referred to (Australian Education Council, 1992) include using mathematical ideas; working in teams; planning activities; communicating ideas; analysing information; solving problems and, of importance to this study, using technology .

Lobbying was successful in 1994, however, in ensuring that the arts are recognised as one of the core curriculum areas, hopefully guaranteeing quality education in the arts for students from P-8 (North, 1994) although compulsory art education from P-10 would have been preferable. Leo (1994) suggests that better art education for the P-8 group will particularly require improved pre-service education for art teachers in the primary sector. Primary teachers have been identified by the 1987 Board of Teacher Registration Survey as demonstrating little sensitivity towards the visual arts and a lack of confidence in teaching the subject (Leo, 1993).

The issue of the placement of technology within the visual arts curriculum has had to occur in a political environment where the survival and acknowledgment of the arts has been a priority concern. However, some commentators consider the prioritising of technology within the curriculum a major solution to exactly this problem. Hicks (1993:45) suggests that technology will improve the status of art programs and art teachers for more than the obvious reasons of the growing importance of visual imagery to people living in an information age. He considers that technology has the potential to eliminate negative stereotypes about art by granting the subject an air of mainstream importance and respectability and states that:

> Information age changes are dictating that art programs are essential. Art teachers have become very important people.

In summary, the broadening of the visual arts curriculum to embrace an understanding of the arts more relevant to children in contemporary Australian society has occurred in theory but in practice, classroom teaching still requires considerable attention. Professional development and in-service training is particularly

needed for primary teachers and for areas of the visual arts curriculum that are poorly resourced and little understood such as multiculturalism and the use of computer technology. The literature indicates that the shrewd use of computer technology may help address problems of status and relevance in the art curriculum.

B. The uses of computer technology in the visual arts curriculum

The literature reveals two basic types of computer based applications that may enrich an art education environment. Firstly, commercially or professionally prepared reference resources such as the National Gallery of Art Laserdisc (1988) and secondly, software tools which allow students to create art works such as graphics, paint or animation programs. Much of the literature falling under these two categories is speculative in nature or refers to special project situations where extra resources or staff have been made available. The experiences of the average visual arts teacher, therefore, are rarely reflected. The following

discussion of the literature, where possible, differentiates between these sometimes contrasting situations.

i) Reference resources

Reference resources can refer either to commercially prepared applications which could be described as products created by commercial companies for national or international release or professionally prepared applications which refer to those products created by teachers or teacher trainers for more localised use and often related to particular curriculum or research projects. The literature is most easily presented under subheadings related to the types of technology involved, namely, laserdisc technology, interactive multimedia CD-ROMs and Internet access to distant sites.

a) Laserdisc technology

At a commercial level, titles suitable for use in an art education setting are growing in number but reports on their classroom use are limited. One such commercial product released

in 1988, is "The National Gallery of Art" laserdisc (1988) which consists of the disc itself and a guide containing a numbered list of 1,645 still frames featuring works from the collection of the National Gallery of Art in Washington D.C. The laserdisc also contains video footage of a narrated tour of the gallery. A special laserdisc player and video monitor are required to use this resource. Works are located by looking through the list of artists provided and then typing the corresponding number of the art work into the remote control device. Miller, Bloyemer and Martin (1988) and Schwartz (1991) speak highly of the potential for use of this type of resource in art education. In particular, they refer to the advantages of having the equivalent of over 1,500 slides available in an easy to manage format and discuss the scenario of teachers combining the laserdisc with authoring systems to create customised, teacher-made computer lessons.

In referring to the possible and potential uses of the technology, however, both articles have ignored the difficult issue of classroom implementation for the average teacher. Along with the purchase of the player and laserdisc, the average teacher would require extensive familiarity with the all the works on the disc and

sufficient preparation time to list the numbers of items appropriate for a particular lesson plan in order to use the resource at its lowest level. Customising the laserdisc to create individual lessons through the use of authoring languages, as suggested, would require extensive knowledge and experience in instructional design and computer authoring to produce a worthwhile result, as well as the considerable time necessary to conceptualise and prepare such a resource.

Laserdisc technology, being simply a very large storage and playback device, can be greatly enhanced by the addition of a computer. For instance, database software which allows field searching of information categories related to the works contained on a laserdisc can both improve the quality of classroom lessons and reduce preparation time. Marschalek (1991) reports on such a database under development for use with "The National Gallery of Art" laserdisc (1988) mentioned previously. Marschalek based the design of the database on the holistic approach of Discipline-Based Art Education. Each artwork is identified by 27 discrete categories of information. This extensive categorisation allows the user to retrieve all artworks related to obvious descriptors such as names,

dates and country of origin as well as more subtle descriptors such as a particular use of colour, texture, compositional structure, media process, purpose or meaning. Teachers may add to the 27 categories, customising the database to suit their own classroom needs. Marschalek suggests thirteen different ways in which such detailed searching combined with the storage capacity of a laserdisc might be used to enhance classroom practice, however, no subsequent reports have been found related to the actual use of this database in the classroom.

Slawson (1993) reports on another special project which uses a computer to enhance the use of the National Gallery of Art Laserdisc and features a game based approach. The prototype project named 'Style!' employs matching and comparison strategies to help beginning students discriminate between elements of visual style such as brushstroke, colour usage or level of abstraction. Classroom trials of the approach saw collaborative and competitive use of the game result in high levels of motivation, enjoyment and success by usually average students.

A promising report from Semrau and Boyer (1991) of a more average classroom setting discusses the student use of "The Vincent Van Gogh Laserguide" (1989) and accompanying computer database. The authors of this report identified a multicultural approach to art as a pressing need in art education and used the field searching capabilities of the database to help students examine cultural issues and develop higher order thinking skills. Using headings such as periods, themes, techniques and influences; groups of five or six searched through the bank of digital reproductions of Van Gogh's paintings and drawings. The laserdisc also contained maps and textual information, for example, letters from Van Gogh's brother, Theo. While noting the predominance of white Western European artists in this type of resource, Semrau and Boyer took advantage of the technology's interactive component to encourage students to investigate and discuss cultural assumptions related to the depiction of men and women, the negative and positive portrayals of work and play and the use of religious symbolism.

Applications created by art educators are reported less frequently in the literature, while it could be thought that

improvements in software and price reductions in hardware would encourage exploration of the medium by more art education professionals. On this issue, Anderson (1985) suggests that reviews of uses of technology in art instruction reveal weaknesses in the content design of art resources due to production teams being mainly made up of programmers while, on the other hand, courseware developed by art educators is found to be lacking in technical sophistication. The involvement of art educators in development teams is therefore seen as being highly important. Anderson also puts forward the view held by Miller (1988) and Schwartz (1991) that some teachers and/or primary and high school students already possess the computer skills necessary to convert slide materials and Discipline-Based Art Education guidelines into in-house computer packages. These packages, it is suggested, may result in materials which are uniquely appropriate to the schools in which they were developed. Nearly ten years after the publication of Anderson's point of view, however, examples in the literature of this type of in-house production of computer packages is difficult to find.

One example of high involvement by art education professionals in the production of a computer resource is a project developed for tertiary level education students. Galbraith (1993) discusses the creation of a laserdisc aimed at preparing pre-service art teachers for their practicum experiences. The resource contains video footage of both innovative and more familiar models of classroom practice so that teachers may examine and reflect upon the complexities of classroom life. The author hopes that the resource will enable students to make links between theoretical understandings and the real-life teaching events depicted on the laserdisc.

b) Interactive multimedia CD-ROMs

Interactive multimedia CD-ROMs have proved to be a much more popular multimedia delivery platform than the laserdisc format, probably due to the convenience of having the device installed directly into the computer. The multimedia industry is currently undergoing a growth period resulting in the creation of many new titles, some of which are highly suitable for visual arts education. CD-ROMs such as "The National Gallery of Art London"

(1991) tend not to use a database style of access but take advantage of a variety of interactive devices. Animation is frequently used to present concepts; hotwords link text references to further explanations or examples and voiceovers, music and videoclips offer further presentation options. Digital manipulation of the paintings in order to explain historical or process aspects, such as displaying different layers of a painting uncovered through restoration, enrich understandings of the artworks in a way that is not possible through gallery visits alone.

The expansion of multimedia titles means that more than the classic masters of white Western European art are being given disk space. "Art Right Now" (1994) is a collection of 450 works by 48 contemporary Australian artists and sculptors. The CD-ROM contains interviews with some of the artists and comprehensive text by noted art experts (McIntosh, 1994a). Such a resource may help fill a gap for art teachers who wish to present and discuss contemporary Australian art in the classroom environment. Some cross-discipline titles which may also be suitable for use in the art classroom include encyclopedias such as "Encarta" (Microsoft, 1990; Duncan, 1994) which contains visual and textual references

to major art movements, art history and processes of art production; the New South Wales board of studies CD-ROM "Oz Id: The search for Australian Heritage and Identity" and "The Encyclopedia of Aboriginal Australia" recently released by the Australian Institute of Aboriginal and Torres Straight Islander Studies (McIntosh, 1994b).

c) Internet access to distant sites

The Internet allows access through a personal computer to a wide variety of art collections both local and overseas such as "The Dallas Museum of Art Online" (Dallas Museum, 1994), "The Leonardo da Vinci Museum" (Pickrell, 1994) or "Yoruba and Akan Art" (Indiana University, 1994). The art collections, digitally stored on computer at these sites, are frequently changed or updated and present an alternative to the fixed resources of a CD-ROM or laserdisc. In some instances, purchase of artworks can be arranged over the network or users may leave comments about their viewing experience. Downloading artworks onto the user's terminal is a simple procedure and a feature of some exhibitions (McKay, 1994). However, this may present an infringement of

copyright in other cases. Art works are generally listed under categories such as art movement or artist since the convenience of database style access is not available at this stage. No reports as yet have been found which explore the use of such international on-line access to art gallery collections in relation to high school visual arts education. There are also no reports yet available on the use of the Internet for joining in discussion groups with artists or sending and receiving picture and text files locally or world wide. However, some art educators mention the future possibility of international collaboration in research and development and direct access to international databases (Madeja, 1993:10).

ii) Software tools for the creation of artworks

The second category of computer applications appropriate for use in a visual arts classroom includes a wide variety of software tools originally developed for art related industries such as desk-top publishing, advertising and graphic design. These programs fit into distinct sub-categories based on their purpose and are available on most computer platforms. Collectively, such tools have the potential to be useful for an extensive range of

existing art curriculum areas and the creation of some new areas. Again the discussion attempts to differentiate between literature of a speculative or special project nature and reports which reflect a more average classroom setting.

a) Graphic design, drawing and painting

Before engaging in a discussion of computer graphics it is useful to clearly define the term. The term 'computer graphics' is frequently used to describe any visual image generated by a computer (Stokrocki, 1986). While this label may have been an appropriate cover term in the early days of computer art when images were developed through the writing of programs which plotted screen coordinates, it is no longer an adequate descriptor of the wide variety of computer images now being created. Although the computer is used extensively in graphics-related industries such as commercial design and printing, this is not their only application. Therefore, for the purposes of this thesis, the term computer graphics will only be used to refer to graphics applications such as advertising and layout.

Graphic design programs such as CorelDraw 3 (1993) are used for page layout, text manipulation and simple graphic design. They often support the use of clip art or pre-drawn graphic images but should not be considered the same as software used for painting and drawing. Computer programs for drawing and painting are less concerned with page layout and include more features which mimic the physical actions of painting and drawing. The ability to edit photographic or experimental images input from peripheral devices such as a scanner or frame grabber are an essential feature of working with such programs. Examples of drawing and painting programs include Adobe Photoshop (1993), Adobe Illustrator (1993), Fractal Painter (1992), Picture Publisher (1993), Deluxe Paint 4 (1993) and DigiPaint 3 (1992).

Roland (1990) states that the common focus of activities using these programs involves students gaining confidence in using the computer 'mouse' or sometimes a stylus as a drawing device, followed by familiarisation with program features and experimentation before finally printing out their efforts on a black and white or colour printer. The resulting print-outs are then displayed as examples of 'computer art'. One of the main

advantages of the use of computer paint programs, Roland insists, is the ease with which images can be edited, mistakes erased and different versions of the same drawing saved. This feature is claimed to encourage experimentation much more than other art media where mistakes are often costly or time consuming to repair and the saving of different stages of the development of the work is physically impossible. Mellifont (1994) believes that this attribute of computers helps to develop an ability to critique artworks because it is not costly for students to redo or undo works in progress.

Other authors have named this unique feature of computer use 'seriation'. Freedman (1991:41) defines seriation as "...the possibility of keeping an image while at the same time changing it." and claims that risk taking encouraged by this characteristic of computer imaging, stimulates students to take a more innovative approach to 'accidents' or things that might happen unexpectedly on screen. Freedman believes that an appreciation of chance or randomness resulting from working with computers is one of four art elements computers contribute to the study of art.

The other three elements are stated as movement, light and audience participation.

Freedman (1991:45) comments that 'as with any art medium, peculiarities of the medium help to define the form' She notes, as does Stokrocki (1986), that especially in the early stages of student use, the computer seems to foster stereotypical images. Instant access to software features which create geometric shapes, pattern fills and clip art sometimes appear to work against the development of a more truthful approach. Freedman recommends that the crucial differences between traditional art media and computer art, particularly in relation to production processes and visual and tactile qualities should be identified and appreciated in order to help students understand the use of stereotypes and move beyond them.

The relative ease of use of the simpler features of paint programs is noted by Roland (1990) as demystifying the sometimes elitist perception of art activity, encouraging less confident students to participate. However, this benefit also has its drawbacks in that the technical aspects of the artworks produced

tends to outweigh their artistic merit. He also notes that the use of the computer to simulate painting and drawing is a shortcoming. The difficulty of mouse input, for many teachers and students who don't manage to move past this level, leads to the decision that using paint and paper is a far easier way to achieve results. Roland suggests that arriving at this decision ignores the real power of the computer. Freedman (1991) also discusses the frustration of students who, seeing that the software attempts to simulate the qualities of paint, find themselves having difficulty achieving the visual effects they expect.

The extension of input devices to include more than just a mouse or stylus is important to the full use of the imaging capabilities of most painting and drawing software. These input devices can include flatbed or hand held scanners for the input of still photography and frame grabbers for the capture of single frames of video tape or television (Roland, 1990). Roland suggests that teachers can expand the options at each stage of the input, processing and output sequence. For instance, options at the output stage should go beyond hanging print-outs on the wall and explore other display formats for computer images.

Drawing and painting software developed for the Amiga computer are used in the Art and Technology Centre at Corinda State High School in Brisbane, Queensland. The Centre is used by art students from years 8-12 and TAFE students as well as being open to other interested students, outside organisations and local businesses. The Centre is well equipped, featuring colour and black and white printers, transparency and slide production and video tape transfer facilities. Peachey and Muller (1994) describe the results of research conducted at the Centre which compared the learning and thinking styles of students with their creative use of technology in the development of still images. Their work addressed questions related to design and creative practice, peer tutoring and self-paced and autonomous learning. They concluded that student interactions, negotiation and collaboration were important aspects of computer learning environments and were overwhelmed by the ability of the computer medium to unleash creativity in students of varying learning styles. They commented on the roles of teachers as facilitators and highlighted the beneficial influence of visiting artists on student creativity.

Chia and Duthie (1993) describe their experiences with a simple paint program in "The School Computers Art Media Project" conducted in Singapore. The special circumstances of the project included twenty exceptional art students, a laboratory of 30 computers with black and white monitors, a scanner and seven attending staff. Four separate art activities were undertaken and are noted here as they illustrate different approaches to paint program use within visual arts education. Firstly, the students used a 'visual memory approach' where they were introduced to the software features and left to generate images from memory of everyday surroundings. Secondly, a two part 'stimulated imaginative approach' was used. A scanned image of Durer's rhinoceros with internal textures removed was presented to the students as a stimulus for exploring textures which then led to student's designing their own fantastic creatures. Thirdly, an 'observation drawing approach' was employed which required students to first complete a concentrated pencil drawing and then transfer this to the computer through the use of the mouse. Fourthly, a 'scanned imagery approach' was used in which student's artwork in traditional media was scanned into the computer as a starting point for further exploration. The researchers noted that

this task demanded the most support from teachers. During the course of the study, Chia and Duthie paid special attention to the interactions of students during the learning experience. Their findings emphasised the importance of collaborative learning approaches between students and teachers which emphasised the benefits of the "social dimension" to learning with computer technology.

b) Animation

Animation programs such as Animator Pro (1991), Deluxe Paint 4 and 3D Studio (1992) allow animation in two or three dimensions. Some knowledge of the features of paint or drawing programs is usually helpful in the preparation of images for animation.

Animation software forms the core of a special teaching/industry initiative involving primary and post-primary schools in the Geelong area of Victoria. (Luck, 1991). The program, known as AD-Venture, has been running since 1989 and may be described as a student production company which specialises in

computer animation and titles for video production using the Amiga platform. Various teams of students and teachers are responsible for promotion and sales, development of logos and corporate image materials, animation story boarding and design, development of company goals and targets, workload allocations, finance management and equipment purchases. The project illustrates the versatility of the computer and its ability to integrate an exceptionally wide range of discipline areas and personnel in an ongoing and productive manner.

Roland (1990) also talks of the computer as a "Time Machine" capable of creating time based compositions such as animations. These may include slide shows and other programmed, dynamic displays. He suggests that it is with these types of applications that the computer demonstrates its potential to be far more than an 'electronic paintbrush'.

c) Sculpture

Three dimensional modelling software such as AutoCad (1993), 3D Studio (1993) , Sculpt Animate (1991) and Real3D

(1991) can be used to design complex sculptures and functional objects, rendering them under a variety of lighting conditions and enabling them to be rotated in space. While such programs are not frequently reported in use in the visual arts classroom, Roland (1990) suggests the possibility of computers being used in the field of sculpture to control kinetic art objects.

d) Video Editing

Adobe Premiere (1994) is one example of a number of software packages which allows digital video editing and offers a variety of tools for achieving special effects and titling. Such software can be used in the creation of stand alone video features, animations or multimedia sequences. While no reports on the use of such software in the visual arts classroom have been found to date, its potential application is noted here.

e) Multimedia

Multimedia is defined by Slawson (1993:17) as describing:

> ...the use of a personal computer to compose, display and manipulate a variety of electronic media simultaneously, combining elements of text and speech, music and sound, still - image, motion video and animated graphics.

One of its distinguishing features is its potential to encourage audience participation. This quality is most frequently referred to as 'interactivity'. In some literature, painting, drawing and graphics programs are referred to as 'interactive' because of the immediacy of results achieved when working with these programs (Linehan, 1983; O'Connell, 1993; Freedman, 1991). However, Slawson (1993:17) more accurately defines 'interactive' in relation to multimedia programs as:

> ..the ability of the 'reader' to control or modify the sequence and structure of experience in the electronic media environment.

Authoring programs used in the creation of interactive multimedia include AmigaVision (1990), Director (1994), Toolbook (1993) and Authorware Professional (1993). Ambron (1990) reports on a variety of classroom activities in subjects other than visual arts which involve students in the production of multimedia presentations. Few reports have yet been published on visual arts applications. However, arts educators such as Slawson (1993) discuss the possibility. Slawson believes that multimedia exploration enables students to express themselves more completely due to the high profile of electronic media in their everyday lives. Roland (1990) notes that multimedia projects encourage a blurring of the distinction between the various arts disciplines and requires team work and expertise in a variety of media areas. For example, as Mellifont (1994) suggests, experience with paint programs is a pre-requisite for multimedia use. Liebhold (1990) suggests that students in all subject areas will need to learn new visual skills and new visual thinking skills and calls for a revitalisation of the fine arts and the creation of new interactive arts.

Summary of Section 2

The literature reviewed in this section reveals that issues related to the status of visual arts education demand the attention of visual arts advocates. The magnitude of these problems which relate to recognition, funding and the provision of adequate professional development has taken priority over concerns about the successful implementation of technology. However, some art educators believe that the use of technology can contribute greatly to the solution of such problems by raising the status of visual arts and increasing the relevance of the subject to students living in an age of visual information.

The literature reveals a considerable variety of ways in which computer technology may be applied to a broad range of art curriculum areas and cross discipline, collaborative projects; making the computer a tool which should be noted for its versatility when compared with other art media. Investigations into its potential as a reference resource or a creative tool are beginning to be more widely reported, however, few studies report

the experiences of teachers using technology in average classroom situations.

As a reference resource, the computer possibly offers a more convenient way to store, retrieve and display a large number of images relevant to all areas of the visual arts curriculum. In particular, poorly resourced areas of the art curriculum such as contemporary Australian art (Leo, 1993) may be addressed through the release of new titles developed for interactive multimedia CD-ROM. Interactive modes of access, common to multimedia resources, have the potential to facilitate investigations into history, aesthetics, media processes and criticism and help develop higher order thinking skills and independent learning among students. It is recommended that art educators, themselves, become involved in the development or customisation of computer based resources through the use of authoring software so that these resources might be improved upon. The recent development of Internet access to art collections or artists in distant locations is yet to be fully explored and offers an interesting area for further investigation.

As a creative tool, the computer offers a wide range of applications suitable for almost every studio area. While it is a fact that affordable software exists for purposes such as drawing, painting, textile design, printmaking, sculpture, animation, photography, film and media studies and multimedia; few studies examine in detail teachers' uses of such software in everyday classroom situations. However, special projects, mainly relating to the use of paint programs, highlight some of the possibilities and problems of working with electronic media. Problems include the frequent use of stereotypical images or images which favour special effects over artistic quality; a lack of appreciation for the unique qualities of computer imaging and a misunderstanding of its applications. Possible benefits of computer imaging include more experimentation and risk taking by students; improvement of the ability to critique and discuss work; exploration of new art forms such as interactive and time based formats and the potential to work as part of team.

Section 3: Implementation of Computers in Education

While few studies specifically examine computer implementation issues connected to visual arts teaching, many studies have been conducted in the general area of computer implementation in education. This section discusses the broad goals of technology use and investigates factors which effect implementation at the classroom level. The motivations of teachers are examined and the predominance of non-creative approaches to classroom use of technology is explored.

A. Goals of technology education

In discussing the implementation of computers in education it is necessary to identify the general goals of computer education and to understand what constitutes successful computer use in the classroom. In many definitions, the computer is seen as only one of a range of 'tools' available for human use and as such is included under the heading of 'technology'. The Australian Education Council (1992:28) considers 'Using Technology' as one of the seven areas of key competencies necessary for ensuring

employment for young Australians and securing the future of the economy. The Council offers a broad range of suggestions for defining technology use including using scientific and technological principles; displaying social and ethical responsibility in the use of technology and accounting for surrounding environs and personal physical capacities.

Bigum and Green (1993) also highlight the importance of broadening the goals of technology education beyond the merely practical to include holistic understandings of the moral and ethical context in which technology operates. Munoz (1991) compares the use of educational technology with that of medical technology in order to highlight ethical issues common to both. Such a view of technology use which incorporates these wider issues is also put forward by Dyrenfurth and Kozak (1991:7) who define technological literacy as:

> ...a multi-dimensional term that necessarily includes the ability to use technology (practical dimension), the ability to understand the issues raised by the use of technology (civic dimension), and the appreciation for the significance of technology (cultural dimension).

While a broadened attitude towards technology use may be significant to curriculum development, from the point of view of the teacher, practical concerns are still most important. Pina & Harris (1993) comment that a high degree of initial success helps to avoid 'learned helplessness' and Van Den Akker *et al.* (1992: 71) consider that the provision of these early successful experiences of classroom computer use for teachers is a key issue. They clarify the notion of successful experiences as follows:

> There are two components of successful experiences: first, the students attain clear learning results; second, the teacher succeeds in an effective lesson execution without major problems, and is aware of his/her own contribution in this respect.

B. Factors effecting classroom implementation

Reports on the majority of studies regarding computer implementation reveal that examples of successful classroom integration of computers are rare. Van Den Akker *et al.* (1992:65) discuss the causes of these disappointing experiences and find them to be related to those variables which also influence curriculum implementation. For convenience, they have categorised

these variables under four main headings: national and/or state contexts; school characteristics; external support and characteristics of the innovation itself.

i) National and/or state contexts

Based on an overview of selected literature, Van Den Akker *et al.* found little research into their first category of variables: the impact of national and state technology policies on the actual use of computers in the classroom. In Australia, such policies would include the recently released Commonwealth Cultural Policy (1994:57) with its emphasis on computer multimedia and the development of an Australian information economy. The role of education in achieving these goals is not frequently mentioned, however, the policy does state that:

> The starting point to realising multimedia products is to build a critical pool of talent with multimedia skills. Our schools and our tertiary institutions need to meet the challenge of new information technologies.

ii) School characteristics

Under the second category of 'School Characteristics', where research has been more frequently undertaken, encouragement from school administrators and principals is considered vital (Van Den Akker *et al.*,1992:69). Top level support is seen as essential for the purchase of equipment, provision of training facilities and streamlining of organisational measures such as timetable rearrangements. The importance of a positive school climate which encourages the exchange of ideas and the critical role of computer coordinators is also emphasised. See (1992) highlights the importance of the school's role in developing technology plans and discusses ten criteria which contribute to an effective approach. These include involving staff in the development of school technology plans; budgeting for long-term staff training along with on-site technical support and regular updates of software and equipment. In Hadley and Sheingold's (1993) extensive survey of approximately 600 teachers noted for their efforts in integrating technology, the lack of administrative support remains a stumbling block. In particular, the provision of

adequate numbers of computers and peripherals and scheduling conflicts presented the greatest difficulties.

iii) External support

The third category put forward by Van Den Akker *et al.* (1992) is 'external support'. The authors suggest that research under this heading mainly relates to the design of teacher inservice experiences and they report frequent criticism of teacher trainers for focusing too much on technical aspects. This has led to recommendations that more attention be paid to curriculum integration, the development of lesson-related hand-outs and the provision of follow up support and guidance. See (1992) and Williams (1990:21) report that inservice training traditionally fails to get past the introduction of equipment features and does little for teachers faced with the classroom reality of curriculum integration. Hadley and Sheingold (1993:283) also note that lack of maintenance, support and advice presented a major barrier at this level.

iv) Innovation characteristics

By far the category which has the greatest impact on the successful implementation of computers is the fourth category of Van Den Akker, Keursten and Plomp's (1992) analysis which looks at the teacher's role and the characteristics of computer use that influence changes in teaching behaviour and beliefs. They draw on Fullan's (1982) summary of influential characteristics of innovations and suggest that weaknesses in one or more of these characteristics can present serious problems. Success, according to Fullan's analysis, requires teachers to understand the need for change and to prioritise it accordingly; to have a clear understanding of the goals and essential features of the innovation; to comprehend the complexity of the learning involved in implementing the innovation and to be convinced of the benefits and practicality of the innovation when compared to the personal and organisational costs.

While Fullan's list refers to innovations in general, Van Den Akker *et al.* (1992:69) confirm its applicability to the current situation involving computer technology and go on to discuss

problems of a more specific nature. They suggest that software and courseware frequently lack relationship to the school curriculum. Poor documentation and lack of teacher guidelines is usually the norm. Software is often designed for individual use and is not suitable for group or whole class work. Drill and practice style software predominates, offering little enhancement to teaching and learning.

Teachers, they note, may not know how to evaluate software before purchase; may have unexpected difficulties with moving from the role of teacher to that of a facilitator and may find it hard to justify the cost of computers due to the management and organisational problems involved in their implementation. Hadley and Sheingold (1993) also identify lack of suitable software and lack of teacher confidence as problems and include insufficient time to prepare lessons which use computers as a major difficulty for teachers.

C. Motivation to use computers

Zammitt (1992) presents a hierarchical view of factors facilitating or hindering the use of computers in schools. The study gathered data through the use of questionnaires and interviews of teachers from a wide range of curriculum areas. The teachers were identified as computer users if they used computers as part of their teaching at least once a term otherwise they were considered to be non-computer users. The study did not involve the introduction of any new equipment, specialist staff or in-service training, therefore, the participating teachers represented a range of average classroom situations. Of the 350 teachers interviewed, it is likely that some came from the visual arts area, although, subject affiliations were not identified in the report.

Analysis of data collected from teachers who identified themselves as users of computers in the classroom resulted in a list of nine main factors which encouraged them to start. The factors, from the most to the least common, were listed as: access to computers; available software; self-motivation to keep up to date; believing students must keep up to date with modern

technology; having a supportive computer coordinator; gaining support from other staff; policy decisions of the school; policy decisions of the faculty and parent expectations that the school use computers.

For the teachers in Hadley and Sheingold's (1993) study incentives to use computers were linked most strongly to perceived improvements in teaching and benefits for students. Among the highest rated of 29 incentives were the perceptions that students showed increased enthusiasm for school work; that the computer was becoming a tool that helped students in their work; that teachers were making subjects more interesting and giving students basic skills that they would need to be computer literate adults.

Seven factors were considered by Zammit (1992) as hindering teachers from the class-users group. These were identified as difficulty gaining access to the computer room, not having enough computers for individual student use, not enough time to review software adequately, the quality of available software, lack of confidence and skill with computers, the

perception that computers were not a high priority in the subject area and the fact that students lacked keyboard skills.

Teachers who identified themselves as non class users of computers in Zammit's study considered that having more computers in departments, more time to discuss ideas with other teachers on the use of computers and more in-service training courses would encourage them to start using computers. The main difficulties perceived by this group were lack of confidence and skill with computers, not enough time to review software adequately, not considering computers a high priority in their subject area/department and not having easy access to the computer room.

Zammit notes the difficulty for teachers of having to learn to use hardware and software and develop classroom strategies at the same time and further suggests that if the schools in the sample were representative of other school situations then in-service training, long term professional development, follow up support in the classroom, financial support

and the development of more effective educational software were priority concerns.

D. Predominance of linear approaches to classroom use

A significant concern about computer use, often clouded by the numerous problems associated with implementation, is that of the one-sided approach to classroom applications which favour left-brain dominance (Dowling, 1993). The most typical approach, Dowling suggests, reflects models of thinking which favour step-by-step logic, predetermined goals, speed and accuracy at the expense of more exploratory and creative approaches. Dowling questions whether the computer can be used in alternative activities which encourage an appreciation of randomness and allow goal flexibility.

The use of multimedia computer software, Dowling suggests, may remedy this situation with its emphasis on multisensory presentation and multiple pathways of exploration. However, Dowling warns of the likelihood of uncreative classroom practices restricting its potential. Dowling's concern is that the

involvement of computers not only supports certain types of activity but automatically validates them. Williams (1990:21) reflects this sentiment stating that:

> Within education there is a tendency to continue to define and value the human niche in terms of skills which technology now demonstrates, such as memory and computation.

Hollis (1991), Melton (1990) and Galbraith *et al.* (1990) discuss the slow evolution of instructional technology from this mechanistic model towards a more humanistic and holistic approach. Hollis suggests that the speed of metamorphosis of current approaches to technology will depend on the efforts of a new generation of instructional designers.

Summary of Section 3

While technology based education comes under criticism for being too narrowly focused on practical concerns to the neglect of social and ethical issues; practical concerns are still of paramount importance to the average classroom teacher. It could be suggested that the many and well documented problems

associated with the use of computers in schools prevents classroom teachers from thinking beyond their immediate circumstances to these wider contextual issues.

Of the problems facing teachers, the most significant inhibiting factors are those relating to the provision of curriculum related inservice experiences, appropriate software, sufficient hardware to promote easy access and technical support. A concern is also expressed among some educators, that mechanistic approaches to the classroom use of computers goes against the grain of humanistic philosophies of learning generally thought desirable by the teaching community.

Section 4. Professional Development of Teachers using Computers in the Classroom

The previous discussion regarding computer implementation highlights the importance of professional development in ensuring successful experiences for teachers attempting to integrate computers into their curriculum. The

literature reviewed on this topic is divided into two main sections. The first section discusses research on the effective design and conduct of professional development for teachers using technology and the second section examines recommendations for providers of professional development to visual arts teachers.

A. Professional development of teachers using technology

Research in the area of professional development of teachers concerned with computer implementation emphasises the key role of the teacher in the processes of change involved in classroom integration. Cicchelli and Baecher (1989:39) discuss the personal dimensions of change as studied by Gabriel (1957) and Fuller (1969) who conceptualised the stages of concern teachers pass through during teacher education. Three main stages of concern were identified. These were firstly, concern about the self; secondly, concern about the task and thirdly, concern about their impact. They suggested that concerns developed hierarchically in this order.

Hall, Wallace and Dorsett (1973) built on Gabriel's and Fuller's pioneering works. They applied the stages of concern theory to teachers who were adjusting to the use of innovations in the classroom setting. The initial three stages presented by Gabriel and Fuller were expanded to seven distinct stages in the 'Concerns Based Adaption Model'. Cicchelli and Baecher applied the Concerns Based Adaption Model to teachers concerns about the use of microcomputers in the classroom. The first stage, Awareness, is described as the stage where the teacher shows little concern about or involvement with computers. The second stage, shows the teacher gaining a general interest in the substantive or informational aspects of computers without becoming particularly concerned about the self in relation to them. At the third stage, the teacher begins to show concern on a personal level. The demands of computers in relation to changing roles, organisational reward structures, personal commitment and potential conflicts all figure highly. During the fourth stage, management concerns become the focus. The teacher is interested in how best to use resources and improve organisation and efficiency. By the fifth stage, the teacher is showing concern about the consequences and impact of computers on those in the immediate sphere of influence.

Important issues are relevance to students, evaluation and changes necessary to increase positive outcomes. At the sixth stage, the teacher is interested in collaborating with others while at the seventh stage, more universal benefits of computers are beginning to be explored. At this final stage, updating or refining of the use of computers is guided by definite ideas on the part of the teacher as to their best uses and roles.

Cicchelli and Baecher's (1989: 44) study stated that:

> Research suggests that appropriately designed inservice activities specifically matched to these concern areas and delivered in logical progression may result in reducing teacher resistance to implementing computer use in classrooms.

Therefore, they continue, intervention strategies should change as teachers' concerns change. They comment that this point is frequently overlooked in inservice activities. Van Den Akker *et al.* (1992) reiterate this suggestion and suggest that since most teachers are in the early stages of this model, where personal survival concerns dominate, small scale successful experiences and basic technical advice should characterise support approaches.

Glass (1992) addresses the longstanding issue of whether professional development activities actually result in transfer of learning to the classroom. The presence of training components which promote transfer of learning in professional development activities was investigated by Glass through the surveying of 97 school systems in North Carolina. The identification of transfer-promoting training components was based on previous research by Ellis (1966) and Joyce and Showers (1983). These components were described as learning under conditions similar to participants' working environments; extensive practice of the original task; the presentation of concepts through a variety of examples; the labelling of important features of the task; the clear understanding of general principles before advancing further; the provision of a variety of stimuli associated with the task and allowing for open ended and structured feed back.

The research conducted by Glass established that among the schools surveyed, these training components were both perceived as important by staff coordinators and employed in staff development activities. Not surprisingly, however, Glass found

that where staff coordinators had more time to spend on staff training, a higher incidence of promotional factors could be found.

B. Professional development of visual arts teachers

The content of professional development courses for visual arts teachers regarding technology has been described as poor by some art educators. Loveless (1990:203) states that:

> Current training, in my view, continues to encourage traditional practices and is oblivious to the present and emerging mental environments created by the newer media technologies that surround us.

With art educators such as Madeja (1993:12) suggesting that electronic imaging and computer based art studies are so central to the art curriculum that it requires "a total rethinking of how we deliver instruction" it is timely to identify exactly what professional development for visual arts teachers should include.

Hubbard and Greh (1991) present a thorough account of just this as they discuss the findings of five art specialists who represented art teachers in a 1989 Special Interest Group project

which considered the problem of what pre-service teachers in a variety of areas including art, needed to know about computing by the time they graduated. One of the outcomes of the project was a set of course proposals that contained knowledge and skills that teachers should possess before entering the art teaching profession. Hubbard and Greh report that an understanding of the application of computers to all four areas of Discipline-Based Art Education was considered necessary. In particular, they suggest that teachers should understand how to use computers for visual expression through both the extension of traditional media and the execution of uniquely computer based works.

The authors differentiate fine art applications from uses of computers in graphic design. In the area of graphic design they suggest that the study of layout, lettering, use of electronic fonts, desktop publishing and production are highly recommended for teachers. They advise that teachers learn to use electronic devices in the design of textiles, costumes, stage settings, architectural renderings, and photography. Hubbard and Greh also suggest that teachers should improve the classroom presentation

of information by becoming familiar with computer based graphics and layout skills.

In the area of aesthetics they stress the importance of training teachers to appreciate the particular qualities and design aspects of computer generated images. On a management level, they believe teachers should be versed in the operational differences of a range of computer platforms to prepare them for the variety of teaching situations they might encounter. They also advocate learning to use the computer as a management tool for filing slide collections, equipment inventories, student records and reports. The use of databases for the retrieval and storage of a variety of information relevant to the classroom is considered important as is the need to be versed in the use of hypermedia and multimedia programs to link useful information. Hubbard and Greh also suggest that teachers should be aware of the range of suitable laserdisc and other electronic resources for use in the study of visual art.

The use of electronic networks is highly recommended as a professional development activity so that teachers may

communicate with each other both locally and state wide and make the fullest use of this facility as soon as they enter the professional setting. Finally, Hubbard and Greh emphasise the need for professional developers to encourage teachers to work as teams in collaboration with teachers of other disciplines, technicians, instructional designers and programmers in order to break down the traditional isolation of the Arts department within the school. This sentiment is also expressed by Hicks (1990) who considers that Visual arts teachers need to be made aware of their crucial role in helping other school staff to understand emerging relationships between art and technology and to initiate these involvements. O'Connell (1993:17) also suggests that the computer may help bring a variety of staff together in new and surprising ways.

The importance of training art teachers to take advantage of the versatility of the computer is emphasised by Roland (1990:60) who suggests that it is only when teachers develop innovative approaches to computer use which take advantage of this quality that technology will become "a viable partner in the art curriculum and not just a diversion."

Summary of Section 4

This section discussed both the design and content of professional development for Visual arts teachers using technology. Firstly, the literature highlighted the need for professional developers to take into account the processes of change occurring within individuals involved in technology use in schools. The research emphasised the importance of matching professional development strategies to teachers' progression through the varying stages of concern. It was noted that, at the current time, most teachers were likely to be in the early stages of development and so require practical guidance and technical help.

Secondly, current discussion about the content of professional development for Visual arts teachers in the area of technology emphasised the necessity to include a wide range of experiences, highlighting the computer's versatility and multiple applications to the Visual arts curriculum. These experiences should consist of fine art applications both as a development tool and new art medium; a broad range of graphic applications; uses of

the computer as a management tool, use of electronic resources and databases, networking and cross-discipline collaboration.

Chapter Two Summary

The literature discussed in this chapter presented an overview of the profound influence of technology on artistic expression and industries involved in the visual arts. A resistance to machine-made art was identified in contrast to the need for artists to contribute their unique talents to the emerging directions of computer technology. In order to place the use of technology in art education in perspective, the political environment surrounding visual arts education was presented as one in which funding, recognition and appropriate professional development are priority concerns. The potential of the computer to help raise the status of the arts and encourage appropriate funding was intimated by some authors.

Problems associated with the implementation of computers revealed by the literature listed a variety of obstacles

on the path to successful classroom integration of computers. These included lack of administrative and technical support, lack of long term professional development and software inappropriate to the curriculum. The importance of the individual needs of the teacher as a key figure in the change processes associated with computer implementation was identified. Finally, qualities of professional development activities which promoted transfer of learning to the classroom were acknowledged and areas of content relevant to art teacher education were discussed in some detail.

Chapter Three Methodology

Chapter Three Outline

The main purpose of this study is to explore how teaching and learning in high school visual arts classrooms might be enriched by the application of available computer technology. This chapter begins by examining a previous study of computer implementation in the visual arts and continues with a discussion of data collection techniques, methods of analysis and types of outcomes appropriate for action research. The goals of this study are then summarised, followed by a detailed description of the evolving research design based on Burns (1994) seven stage cycle of action research as presented in **Diagram 3** (p. 122).

Research Methods and Previous Computer Implementation Projects in the Arts

A. Similar studies

As already indicated in the literature review, studies that investigate computer use in visual arts education are not frequently reported. Some that have been reported are speculative in nature and focus on potential rather than practice. Others focus on children's use of computers under special circumstances. One study, comparable with this thesis, which investigates the experience of professional development in the area of art education and technology is presented by Campbell (1991). He used a descriptive approach to examine art teachers' perceptions of the classroom implementation of computer graphics. The stated goals of Campbell's study (1991:115) closely reflect those of this thesis. Campbell sought to describe art teachers' perceptions of computer technology; the requisite skills and knowledge for teaching in this area and ways in which technology could be implemented effectively in the classroom. A computer graphics inservice course for teachers, conducted by Campbell, was used as the focus for the

investigation. Data collection consisted of a profile sheet completed by participating teachers before the inservice, a questionnaire mailed to participants after the inservice and field notes kept by Campbell during the course itself.

Analysis of Campbell's data revealed that the inservice activity was typically too short for the amount of information that was covered. Campbell suggested that each of the 6 x 3 hour sessions could have become separate in-depth courses in themselves. Some of the planned projects could not be achieved by the teachers in the allotted time and the main benefit of the course appeared to be the demonstration of a range of software which included several different paint, animation and slide show packages for both the Apple McIntosh and the Amiga platforms.

Although the inservice was entitled 'A Computer in the Art Room', the course was not conducted in an art room but in a computer laboratory. Of the six teachers who took part, only one had a computer in the classroom; the other five participants had access to computer laboratories. Campbell does not note any differences in teaching strategies necessary for the use of a single

computer in an art classroom where there are other activities in progress and the whole class approach needed to teach in a computer laboratory.

Campbell's discussion of his investigation emphasised the importance of taking into account the entry level experiences and interests of participants. He further suggested allocating sufficient time during inservice courses for participants to work at their own pace on their own choice of project and commented that it would be useful if course content also took into account the grade level being taught by the participating teachers.

Campbell reports that his study raises questions about the effectiveness of such inservice courses as transfer of knowledge was minimal. He suggests that the participants' lack of a supportive school environment contributed to this outcome. Nevertheless, he states that the inservice was useful in broadening teachers' perceptions as to the possibilities for computer use in the visual arts.

B. Data collection techniques

Stokrocki (1986) used qualitative description based on observations recorded in diary entries, questionnaires, informal interviews, photographs and documents to study the experiences of gifted adolescents (11 - 16 year olds) during a two week summer course in microcomputer graphics. The course she chose to observe focused mainly on the use of programming languages to plot numbered co-ordinates which created simplistic images and patterns on black and white monitors. Of course, since the time of Stokrocki's study; software and hardware, particularly monitors, have advanced considerably making comparison with other more recent studies difficult. Nevertheless, analysis of Stokrocki's observations contributes some valuable insights into the hindrance to instruction caused by students' 'lack of readiness'. She clarifies this situation and describes it as being made up by such psychological considerations of students as stubbornness, game-playing, immaturity, lack of confidence and overconfidence.

Stokrocki's data collection techniques illustrate the manner in which qualitative research disciplines encourage the gathering of data from a variety of sources in order to gain more than one view point of the subject under investigation. Burns (1994) describes this process of triangulation as the use of two or more methods of data collection. Sagor (1992:43) favours the use of three methods of data collection and discusses the use of triangulation in action research as a method for ensuring the quality and validity of findings, noting the ability of three view points of a phenomenon to reveal a more comprehensive picture than one viewpoint alone. He suggests that the main benefits of triangulation are its ability to compensate for imperfections in data gathering instruments; increase confidence in results or alert researchers to important questions if data is found to be contradictory. Sagor (1992:29) notes that in action research, it is important to realise that the purpose of data collection is not to establish generalisabilty but to explore, describe and ultimately understand what is happening in the context under study.

C. Analysis of qualitative research

While neither Campbell nor Stokrocki were explicit about their analysis techniques, Corbin and Strauss (1990) recommend a variety of analytic strategies appropriate for use in qualitative research. These strategies involve categorising information gained from data collection in order to facilitate the identification of emerging relationships. Category names may be derived from the situation itself, the language used by participants or previous research. A process of open coding is first used to identify categories, define their properties and dimensions and seek out similarities and differences. Axial coding is then used to look for relationships between categories and subcategories. Corbin and Strauss suggest that logic diagrams may be used at this stage to aid in the formation of concepts and themes.

Strauss and Corbin (1990:51) recommend several uses of technical literature in qualitative research other than assisting in the identification of categories. They suggest that familiarity with relevant literature may enhance theoretical sensitivity, resulting in a greater awareness of specific issues when in the

field. They note that literature may also be used as a second source of data which may contrast or verify data already collected by the researcher. A thorough reading of previous research may also stimulate questions which guide the initial direction of the study or direct analysis.

D. Outcomes of qualitative research

Peshkin (1993:24) discusses the outcomes of qualitative research as beneficial for their ability to describe, interpret, verify and evaluate the realities under investigation. Description, he comments, though traditionally devalued as a form of research, contributes a sound foundation for future inquiries. Interpretation offers explanatory clues; develops new concepts and elaborates existing ones. Verification helps to establish the utility of assumptions, theories and generalisations and evaluation enhances understandings about policies, practices and innovations.

Peshkin's categorisation of possible outcomes contributes to an understanding of the benefits of such research as Campbell's and Stokrocki's. For example, Campbell's study describes

relationships, people, processes and settings involved in the professional development of art teachers at a computer inservice. His description and interpretation may lead to insights that change the behaviour of professional developers or refine knowledge about the appropriate content of inservice activities. His study may provide the foundation for future inquiries as well as pointing to areas for further investigation. Findings from Campbell's study verify assumptions about the perceived benefits of computer inservices and contribute to the evaluation of the worth of computers in an art education setting.

Study Goals

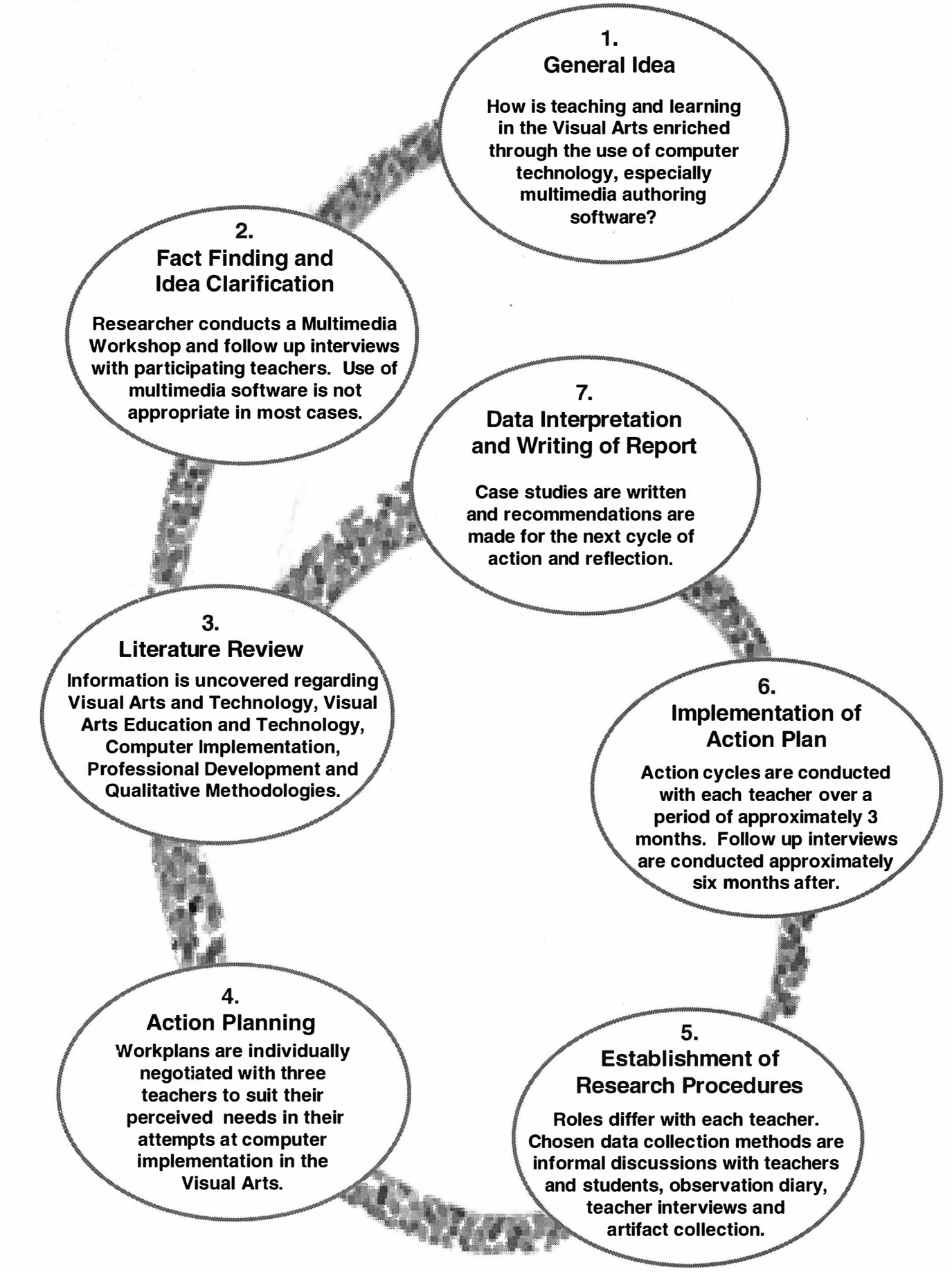
As discussed in Chapter One, an action research approach was chosen for this study because of its ability to bridge the gap between academic theory and classroom practice. Using a problem solving approach, this methodology aims to improve everyday teaching situations and therefore may result in a variety of goals being served. In particular, Burns (1994) describes the ability of action research to offer a means of in-service training in which teachers can gain new understandings, improve skills and heighten

self awareness. Bresler (1994) describes one of the possible purposes of action research as personal fulfilment and empowerment.

For the teachers participating in this study, the research met both the goal of in-service training and that of empowerment. For the researcher, the main goal was one of improving her skills in assisting teachers in the implementation of computer technology. For all concerned, fulfilment through the completion of collaborative art and technology projects during the course of the study was an additional benefit. Another important goal of the research is a contribution to theoretical understandings of both computer based education and art education. It is possible that this study may enrich the professional practice of others involved in computer based education and art education who are able to identify with the descriptions and analysis reported here.

Research Design

Diagram 3



STAGE 1 : Identification of the General Idea

Burns (1994) describes Stage One of the research cycle as the point where a general idea, perceived as being critical to an everyday teaching situation, is identified and considered worthy of investigation.

The idea which served as the starting point for this study emerged from a variety of factors. Firstly, the researcher is aware at a personal level, that visual arts education is often devalued within the school setting and considered of little relevance to the future of students. This awareness contrasts strongly with the researcher's beliefs about art and the importance of visual images to contemporary society. In particular, the researcher's experience with computer technology and interactive multimedia highlights the significance of the visual arts to an information society where digital images are contributing to a revolution in communications, education and entertainment and offering a source of potential growth to the Australian economy.

Secondly, the researcher was aware that, since the mid 1980s, many art classrooms had obtained computer technology that was capable of being used for a wide range of art activities including graphic design, image manipulation, animation, video editing, three dimensional modelling and the creation of interactive multimedia programs. Thirdly, prior to the beginning of this study, interactions with art teachers and teacher trainers led the researcher to believe that in many classrooms, little had been done with the available technology and that art teachers were having difficulty realising the potential of computers in their subject area. Teachers had little support or professional development in the use of computers and due to their extremely busy lives, had little time for the consuming nature of learning about technology.

Over a one month period, informal discussions took place with six education professionals involved in technology, art and teacher training in order to gain further insights into the general area. These interactions varied greatly in nature. While some professionals could be described as helpful, others were quite unsupportive. The use of jargon and the desire to keep technology and related information exclusive characterised their approaches

and made communication difficult. However, general reflections on these conversations led to the formulation of an idea for investigation which highlighted the use of multimedia authoring software and computer technology in the high school visual arts classroom.

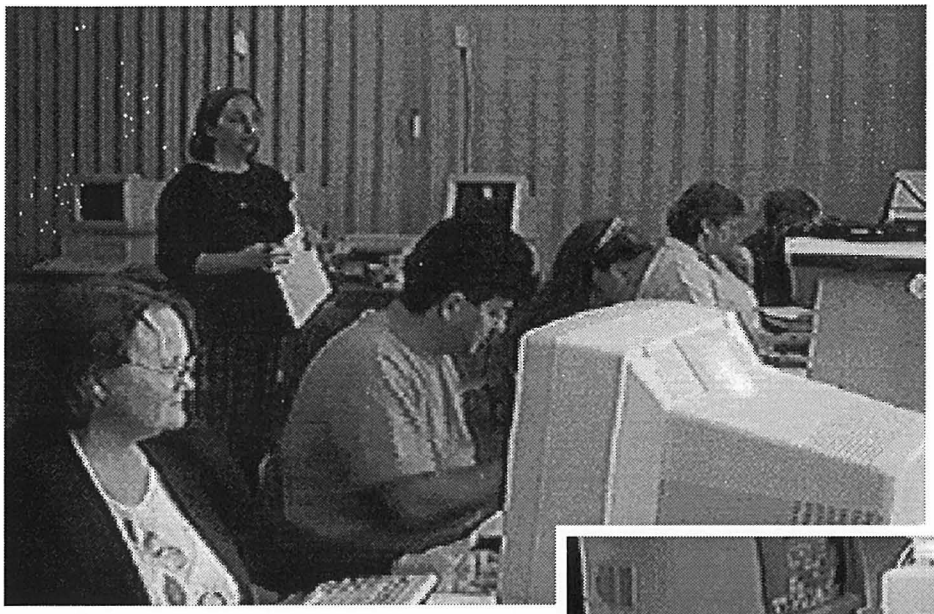
STAGE 2: Fact Finding and Clarification of Initial Idea

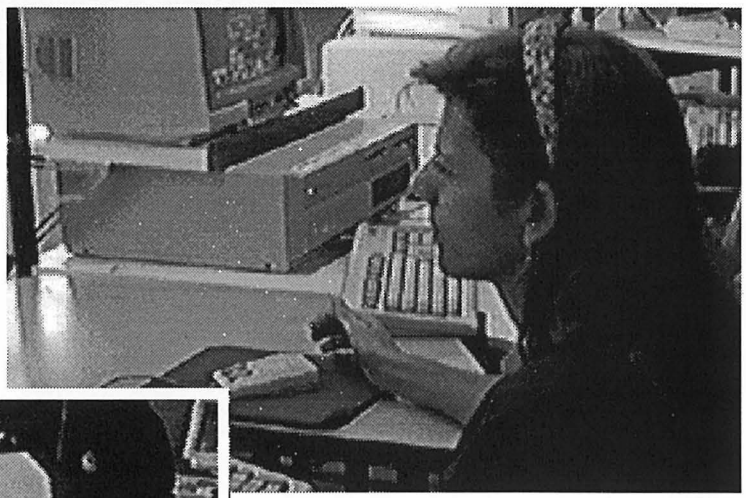
The second stage of the action research cycle, according to Burns (1994), involves a period of fact finding in order to clarify the research idea. For the purposes of this study, it was considered important to uncover such information about teachers as their perceptions of enrichment; their current uses of technology; influences which facilitated or hindered classroom use and their needs in relation to technology use. The researcher was particularly interested in their perceptions and potential use of multimedia authoring software.

Interviews and classroom interventions, typical of fact finding in educational research, can place great demands on the time and energy of teachers. In order to compensate participants

for their involvement and in keeping with an action research philosophy of offering practical assistance to teachers, the researcher conducted what she considered to be a mutually beneficial workshop. For the researcher, the workshop provided a way of locating possible candidates for the study and for the participating teachers, it provided some much needed hands-on experience and tuition. Frame grabbed images from the workshop are shown in **Illustration 3**.

The focus of the workshop was on the use of the multimedia authoring package AmigaVision (1990) for the Amiga platform. The workshop was advertised in the publication of the Queensland Art Teachers' Association (March, 1993) which reaches approximately 300 teachers throughout Queensland. The majority of these teachers live in the Brisbane metropolitan area. The advertisement required participants to have at least one Amiga computer in their classroom; have an interest in multimedia and be willing to participate in a one-day workshop and later interactions with the researcher which might include classroom intervention.





Possible candidates for the study attended a one day workshop in multimedia authoring. Although the workshop itself was successful, with all participants building an interactive presentation featuring fine art works and a self-scoring test, transfer of the experience to their classroom settings was difficult. Therefore, the research focus opened up to include a broader range of art activities more suited to the varied level of development of the study participants.

Queensland University of Technology made available five computers and a room for the workshop. In order to provide hands-on experience for the teachers, participant numbers were necessarily limited to the number of available computers. Out of ten teachers who replied to the advertisement, five were selected on the basis of their school's geographical proximity to the researcher as this factor would be important to later phases of the study when frequent school visits would be necessary. Four female teachers and one male teacher attended. They represented both private and state schools located in areas of varied socio-economic status.

Art teachers do not receive release time from classroom teaching for professional development so the workshop was run from 9am to 3pm on Saturday, May 1st, 1993. The workshop began with the presentation of two interactive multimedia projects constructed with AmigaVision. The first project, created by the researcher, allowed the user to choose from images of three public sites around the inner city area of Brisbane. These sites then became backdrops for a choice of five sculptures. The user was able to place each of the sculptures in the site and consider the

effects of context, scale and public use of the area on the meaning and aesthetic values of the artwork. The second project was a student-created multimedia program, again using AmigaVision, which presented a variety of famous art works on screen and asked users to identify the art movements to which they belonged using a type-in-answer format. Workshop participants were also briefly introduced to a simpler and less expensive authoring package entitled *Hyperbook* (1990).

For the rest of the workshop, participating teachers were involved in the hands-on construction of a project of their own using AmigaVision. Prior to the workshop, photographs of twelve famous artworks were framegrabbed by the researcher and saved as digital files. As well, a twelve page step-by-step guide was prepared for each teacher. The guide detailed eight separate AmigaVision features necessary for the creation of the project. Participants were directed through each step of the project which took the majority of the allotted time to complete. By the end of the day, all teachers had successfully and without difficulty, constructed an interactive sequence of images which incorporated

text, sound effects and music, gave feedback to answers typed in by users and recorded and presented the users name and calculated a final score.

Follow up interviews with each teacher were then scheduled for later that month. The semi-structured interviews were conducted at each teacher's school and lasted approximately 45 minutes. The interviews were recorded and the resulting transcripts analysed using a process of coding recommended by Strauss and Corbin (1990) which involved breaking down the teachers' responses, paragraph by paragraph, into discrete units of information. Each unit was labelled and categorised. Some of these categories reflected labels used in the literature such as 'External Support' used by Van Den Akker *et al.* (1992) while other labels were not explicitly referred to such as 'Helpful People' or 'Supporting Resources'.

Reflection at this stage of the research cycle led to a critical review of the problem. The analysis revealed that most of the participating teachers were in the rudimentary phase of computer implementation in their classrooms. The rudimentary

phase of computer usage is described as having the following characteristics.

1) Computer projects

Computer projects, in the rudimentary phase, lack variety and typically involve a limited studio focus on the graphic design areas of layout, lettering and advertising. The computer is rarely used with a history, critique or aesthetics focus. A lack of variety in display formats is also evident. Computer print-outs are typically the only outcome of computer use.

2) Hardware/software

Input devices, other than the mouse, such as scanners or framegrabbers are unavailable or infrequently used. Prescanned images are not available. A limited range of software is available or in use. Software is used by students at its most basic level.

3) Curriculum integration

Computer projects lack integration with other classroom activities and the visual arts curriculum in general. The wider implications of technology use and issues related to technology and the visual arts are not addressed as part of the curriculum.

4) Patterns of student use

Patterns of student use are haphazard. An unequal distribution of computer use amongst students is typical. Few or no facilities are available for students to use technology for visual arts projects outside class hours.

5) Supporting resources

Teaching resources such as examples of computer art, examples of the application of computers to careers and tertiary studies, instructional charts or idea generators are limited or not available.

6) Support personnel

Teacher lacks the help of support personnel with experience in art related applications of technology and does not have access to reliable maintenance services.

7) Personal use

Teacher rarely uses computer for personal creativity, management, entertainment or education.

8) Communication

Teacher has little or no constructive communication with other teachers using technology, especially within the visual arts subject area.

9) Future plans

Future plans are vague or involve a piecemeal approach to the overall use of computers in the visual arts curriculum. Budget concerns do not include the purchase of teaching resources or funding for ongoing professional development.

Examples from the literature that discussed ideas for exemplary teaching practice using computers (Anderson, 1985; Bigum & Green, 1993; Chia & Duthie,1993; Dowling, 1992; Duncan, 1993; Freedman, 1991; Hammond, 1993; Hicks, 1993; Hubbard & Greh, 1991; Knerl, Bloyemer & Martin, 1988; Luck, 1991; Madeja, 1993; McIntosh, 1994a; Roland, 1990; See, 1992) were then referred to in order to create a possible description of an advanced phase of computer use. Characteristics of the advanced phase are summarised in **Diagram 4.** The differences between the rudimentary and the advanced phases were considered to be quite pronounced in terms of the level of resources and professional development required for a teacher to move from one phase to the next. Therefore, an intermediate phase is suggested by the researcher, based on her professional experiences, so as to offer a transitional category for teachers who may not be able to identify themselves as being at either the rudimentary of advanced levels.

Early Analysis and Reflection Revealed the Following Possible Stages of Computer Implementation in Visual Arts Education.

Diagram 4

Stages / Characteristics	Rudimentary Phase	Intermediate Phase	Advanced Phase
1. Computer Projects	Projects lack variety; rarely involve a history, critique or aesthetics focus; display formats limited to printouts.	Projects extend beyond graphic design exercises to include projects from other art disciplines.	Projects represent all art disciplines and display formats demonstrate an experimental approach.
2. Hardware/ Software	A limited range of software is available and most likely used at its lowest level; scanners or framegrabbers are not in use.	A variety of software is available and skilfully used; scanners or framegrabbers are beginning to be used.	A full range of software is available and used at an advanced level; scanners or framegrabbers are frequently in use.
3. Curriculum Integration	Projects lack integration with other activities; wider issues of technology use are not addressed.	Computer projects are sometimes linked with other activities; wider issues of technology use are sometimes addressed.	Computer projects are fully integrated with other activities; wider issues of technology use are addressed.
4. Patterns of Student Use	Student use is haphazard; unequal usage patterns are evident; out of hours student facilities are unavailable.	More regular and equal usage patterns emerge; out of hours student facilities are sometimes available.	Equal and consistent usage patterns are evident; out of hours student facilities are regularly available.
5. Supporting Resources	Teaching resources such as examples of computer art; instructional charts or idea generators are not available.	Some teaching resources are available although usually limited and lacking in variety.	A wide variety of teaching resources available and regularly updated.
6. Support Personnel	Teacher lacks the help of support personnel and does not have access to reliable maintenance services.	Teacher has unofficial help from support personnel and has some access to reliable maintenance services.	Teacher has regular assistance from support personnel and has access to reliable maintenance services.
7. Personal Use	Teacher rarely uses computer for personal purposes such as creative projects, management, education or entertainment.	Teacher sometimes uses computer for personal purposes such as creative projects, management, education or entertainment.	Teacher frequently makes personal use of the computer for a wide variety of purposes.
8. Communication	Teacher has little positive interaction with others regarding computers, especially within the visual arts subject area.	Teacher occasionally interacts with others regarding technology use within the Visual Arts.	Teacher frequently interacts with other users, especially within the visual arts and takes advantage of electronic networking.
9. Future Plans	Future plans are vague or involve a piecemeal approach. Budgets do not include the purchase of teaching resources or professional development.	Future planning is evident but may not demonstrate a holistic approach to computer use or include funding for resources or professional development.	Future plans are well considered and include the on-going purchase of teaching resources and long term professional development.

Based on the phases presented in **Diagram 4**, Teacher One, Teacher Four and Teacher Five were considered to be at the beginning of the rudimentary phase. Teacher Two was placed in the middle of this phase and Teacher Three was considered to be at the end of this phase of computer use. From this analysis it appeared unlikely that any of the workshop participants would use multimedia authoring software as part of their teaching practice. This revelation led to a clarification of the general idea which involved a less ambitious approach and focused on the enrichment of visual arts education through the use of computer technology in a way that did not include the expectation that teachers would use multimedia authoring software. It was also decided that methods other than inservice workshops might be required to assist teachers in the enhancement of their teaching practice.

STAGE 3: Literature Review

For Burns (1994), Stage 3 of the research cycle is an appropriate time to conduct a review of relevant literature which might provide clues about possible problems and procedures and

provide background information to the research focus. In reality, the literature review was a continual process which varied in intensity throughout the cycles of action and reflection depending on the demands of the time.

The review of literature related to this study sought to discover reports about difficulties with computer implementation; the professional development of teachers using innovations; examples of how computer technology could be used in the visual arts classroom; the relationship between computer based activities and the visual arts curriculum and the methodological basis of other studies concerned with visual arts education and technology. These reports are referred to in the corresponding sections of Chapter Two.

As Corbin and Strauss (1990) suggested, the literature review served to improve sensitivity to issues during later observations in the field. Along with an analysis of the interview transcripts from Stage 2, the literature review highlighted problems with inservice workshops, revealed common difficulties and painted a picture of the many possibilities of computer use in

the visual arts classroom as both a resource and a creative tool. In particular, teacher training which related to the context of the individual and that was responsive to the level of development of those involved was emphasised in the reports of Van Den Akker *et al.* (1992) and Cicchelli and Baecher (1989).

STAGE 4: Planning Action

Burns (1994) describes Stage 4 of the research cycle as the moment where analysis of the findings so far results in a feeling of confidence sufficient to guide action. By Stage 4 in this study, it had become apparent that in order to explore the use of computer technology in the visual arts classroom and to assist teachers in their implementation efforts, an appropriate plan of action would require close personal negotiation with each participating teacher. To facilitate this personalised approach, the initial workshop group was reduced from five to three, again on the basis of geographical proximity to the researcher. These three teachers represented a variety of educational settings and classroom needs. Negotiation with each teacher resulted in the

conceptualisation of three different approaches to the problem of how to enrich visual arts education through the use of available computer technology.

Teacher One had the least experience with computers and stated that in order to feel comfortable teaching with technology, the development of her own skills was most important. She expressed the need for one-to-one tuition where she could control the pace and repeat steps until she felt comfortable. Furthermore, she stated that learning about technology through solving hypothetical design problems was not as effective as working on real life design tasks that crossed her desk everyday. Therefore the plan of action negotiated with this teacher involved a series of one-to-one tuition sessions aimed at improving her skills and confidence and that included design experiences which responded to her daily professional practice. Teacher One was considered to be at the beginning of the rudimentary phase described in Stage 2 of the action research Cycle.

Teacher Two had a limited amount of experience with computers and stated that she had been having difficulty relating

computer activities to the art curriculum. She also expressed the desire to develop the skills of students from year 10 who might then be able to act as peer tutors during their senior years. Therefore the plan of action negotiated with this teacher involved an in-class project with two groups of five year 10 students. The project aimed at integrating computer work with their class activities. Teacher Two was considered to be in the middle of the rudimentary phase.

Teacher Three was the most experienced computer user. She was interested in giving a select group of students from across a range of year 10 art classes, experience in developing a multimedia project that could be shown at the school's annual art exhibition. As with Teacher Two, Teacher Three also believed that the students' experiences would be indispensable in peer teaching situations in years to come. Teacher Three was considered to be at the end of the rudimentary phase.

STAGE 5: Establishment of Research Procedures

Burns (1994) suggests that Stage 5 of the research cycle involves making decisions about specific research procedures such as allocation of roles, choice of materials, data collection and the negotiation and discussion of details of the proposed plan of action.

1. Allocation of roles

Burns (1994) considers that clear identification of the roles of those participating in the implementation phase facilitates productive collaboration and enhances transferability. For the teachers in this study, allocation of roles was negotiated in the light of what they considered to be most helpful to the enrichment of visual arts through the use of technology in their particular classroom.

The relationship between Teacher One and the researcher was that of student and teacher, respectively. The researcher trained Teacher One in the use of the computer. The relationship between Teacher Two and the researcher was that of team

teachers. In this case, the researcher's interventions took place in the presence of Teacher Two while a variety of other art activities was in progress. The relationship between Teacher Three and the researcher was one of Head of Department and visiting expert. Teacher Three's aim was to benefit as many of the year 10 art classes as possible in order to encourage an interest in art and technology among these students. It was the shared hope of both Teacher Two and Teacher Three that participating students, through their experiences with the researcher, would demonstrate confidence and expertise to their peers in later years

2. Choice of materials

The materials used in each case were those already available at each school. No special equipment was introduced for the purposes of the study. This resulted in the researcher being involved in a wide variety of teaching situations. At the beginning of the study, Teacher One had only one Amiga computer for student use although a good range of image-editing software was available such as Deluxe Paint III and DigiPaint 3. However, between the time of the negotiation session and the beginning of the activity

sequence; the school P & C committee purchased an IBM 486 computer for the exclusive use of art teachers at School One and located it in their staffroom. A suitable graphics software package (CorelDraw 3, 1993) was made available to Teacher One by another member of staff and an unused scanner was located and attached to the computer. During the course of the study, Teacher One was also able to get access to a laser printer through the connection of a cable between the art staffroom and the Administration office.

Teacher Two had five Amiga computers located in her classroom as well as a colour ink jet printer (Hewlett Packard 500c). A copy of Deluxe Paint 3 was on the hard drive of each computer but no other graphics or image editing software was available. A switchbox which allowed each of the five computers to link up to the printer without recabling was available and was installed towards the end of the action cycle.

Teacher Three had 10 Amiga computers that were located in an annexe which led to the main area of the classroom. An unused security camera had been hooked up to one of the computers as a digitiser but was being repaired during the time of the

intervention. A black and white and colour printer were also located in this area. A good range of image-editing software was at hand, including DigiPaint 3 and Deluxe Paint IV which was accompanied by two instructional videos. A copy of AmigaVision was also available.

3. Timetabling

Sessions with Teacher One were conducted after school hours, usually between 3:00-4:30pm. The sessions began in her classroom but moved to the art staff room when the new equipment arrived. Sessions with Teacher Two were arranged to coincide with a double art period for year 10 students and took place between 1:00-3:00pm. Participating students came in early from their lunch hour which usually ended at 1:15pm. Debriefing with Teacher Two took place between 3:00 and 3:30pm. Sessions with Teacher Three were arranged on a rotating schedule. This approach was designed to avoid repetitive disruption to the attendance patterns of participating students who came from four different

classes. The teachers involved gave their permission to release students who did not have art during the timeslot which corresponded to the researcher's visits.

4. Data collection

Data collection, in each case, consisted of taped interviews and informal discussions with teachers; the keeping of an observation diary by the researcher; informal discussions with students and artefact collection where appropriate. The variety of data collection techniques assisted in the triangulation and validation of findings by offering different perspectives which could then be compared.

STAGE 6: Implementation of Action Plan.

Stage 6 in Burns' (1994) description of the research cycle involves the implementation of the action plan. The action sequences for the three teachers are shown in the following tables.

Teacher One, School One.	
Session 1 6/7/93	Explanation of basic features of DigiPaint 3 on the classroom Amiga. Explanation of basic features of Coreldraw 3 on the staffroom IBM.
Session 2 13/7/93	Text manipulation on IBM. Cable connects IBM to Administration office laser printer. Creative Project: Poster for upcoming School Arts Night featuring text manipulation and page layout skills.
Session 3 27/7/93	An unused Scanner has been found and attached to computer. Introduction to use of scanner and image editing.
Session 4 23/8/93	Creative Project: School Magazine cover featuring full page scanned image of student grey scale drawing, text manipulation and layout.
Session 5 30/8/93	Revision of program features. Advanced text manipulation and layout. Clip art customisation. Creative Project: T.Shirt design for senior school excursion to Thredbo.
Session 6 6/9/93	Creative Project: Layout and graphics for 3 advertisements to be run in the publication of the Queensland Art Teachers' Association.

Teacher Two, School Two.	
Session 1 26/8/93	Discussion of project aims with Group 1. Introduction to image editing programs.
Session 2 2/9/93	Discussion of project aims with Group 2. Introduction to image editing programs.
Session 3 9/9/93	Videoing of student works from Group 1. for framegrabbing. Reinstallation of hard drives.
Session 4 7/10/93	Videoing of student works from Group 2. for framegrabbing.
Session 5 14/10/93	Image editing and development of student works from Group 1.
Session 6 28/10/93	Image editing and development of student works from Group 2.
Session 7 4/11/93	Finalisation of images and print outs.

Teacher Three, School Three.	
Session 1 24/7/93	Introduction of project to student group. Democratic selection of topic for multimedia presentation. Division of tasks and allocation of teams.
Session 2 1/9/93	Familiarisation with image editing programs. Clarification of content and team tasks.
Session 3 7/9/93	Videoing of photographic images from books and posters. Experimentation with image editing programs.
Session 4 14/9/93	Editing of framegrabbed images.
Session 5 6/10/93	Preview of animation sequence. Continuation of image editing.
Session 6 14/10/93	Addition of text to images. Experimentation with screen design.
Session 7 19/10/93	Programming sequence using AmigaVision.
Session 8 26/10/93	Shaping of image sequence. Addition of music, sound and synthesised speech.
Session 9 3/11/93	Addition of menus and interactive items.
Session 10 9/11/93	Finalisation of program. Presentation of program at annual exhibition.

STAGE 7: Data Interpretation and Writing of Report

The final stage of each cycle of action research as described by Burns (1994) consists of data interpretation and the writing of the research report. The interpretation of data continues the process of categorisation discussed in Stage 2. At this point, the researcher is able to identify emerging relationships between categories through a more focused coding approach such as axial coding described by Corbin and Strauss (1990). Further reflection on the research experience contributes to a holistic understanding of the focus question but the ultimate evaluation of an action research project is evidenced in the improvement in the teaching practices of the participants.

Burns (1994) and Kemmis (1994) recommend that the writing up of action research studies should follow a case study format. Burns suggests an historical approach which shows how events unfolded over time and how participants changed during the course of the study. Therefore, in Chapter Four, a case study of each of the participating teachers is presented. The case studies were presented to the teachers for verification in order to increase the validity of the findings.

While report writing represents the final phase of the cycle, action research often consists of many cycles and may continue indefinitely. Findings from each cycle inform the planning stages of future action and result in the refinement of the original idea or the discovery of a new direction or topic for investigation. The study reported here constitutes one cycle of action and reflection and as such the findings advise further actions for each participating teacher which are presented in the appendices.

Chapter Four Findings

Chapter Four Outline

In this chapter, the findings are presented in a case study format following the advice of Burns (1994) and Kemmis (1994). The case studies aim to facilitate an understanding of the particular context surrounding each teacher and report on the sequence of action and reflection in which the researcher was involved. Each case is presented in four main sections starting with the Beginning Interview and the Action Sequence and concluding with the Follow Up Interview and Researcher's Reflections.

CASE STUDY: TEACHER ONE

Teacher One: Beginning Interview

School One profile

School One is located in an inner city suburb of low to middle socio-economic standing. A comparatively high percentage of students at the school come from a non-English speaking background and many are of Vietnamese origin. In recent years school numbers have been declining, discipline problems were frequent and the overall tone of the school was occasionally negative. The art staff consisted of three teachers, two female and one male. According to Teacher One, art did not have a high priority within the school and was not valued by the school administration. The music department was an exception. The School Band performed regularly at assemblies and had a good success record at interschool competitions.

Teacher One profile

Teacher One had been a high school visual arts teacher for about fifteen years. Her specialist areas were painting, drawing

and ceramics and she was a long standing and active member of the Queensland Art Teachers' Association. Recently, she had become a member of the school's newly formed technology committee. The committee's aim was to improve the use of technology in areas such as manual arts and science but due to Teacher One's attendance at some of their meetings, they were now also considering the needs of the visual arts area.

Teacher One had not used computers during her secondary or tertiary education and her few experiences with computers since then had been characterised by equipment malfunctions. At home, she had an IBM compatible computer that was given to her after it had been in a car crash. She had used it briefly for word processing tasks but it no longer worked. During the Christmas holidays, she had taken the classroom computer home with the intention of learning to use it but had found that she had become bored very quickly. The classroom computer, an Amiga 2000HD, had also developed operating problems and was regularly unreliable.

Teacher attitudes

Some anxiety was evident in Teacher One's perception of computer technology. She stated that:

> I often feel bamboozled by it. There's so much of it and it changes and happens so fast, I can't keep up. I know a really small amount about computers. They're never going to be my personal area but I feel I need to learn about it and try to keep up.

It was evident from this comment and later conversations that Teacher One saw little connection between the use of technology and her specialist areas of painting, drawing and ceramics and that this attitude was partly due to the difficulties of learning how to use computers. Furthermore, she felt pressured to incorporate technology into her art program but was unsure how.

Her motivation to use technology was based on a vague recognition of the needs of visual arts students to be exposed to technology because she believed they would be likely to encounter computers in the workplace. In her current situation, she felt computers could be most useful in the completion of such tasks as newsletters and posters which she was frequently required to do

for the school. She was aware that the IBM compatible program, CorelDraw 3 (1990) had been used to develop the Queensland Art Teachers' Association publication and stated that she lacked confidence in the ability of the Amiga platform to be used for such jobs.

In her attempts to learn how to use the computer, she had found manuals were useful for understanding what symbols meant but generally were of little help. Other workshops she had attended had been very brief or of a demonstrative nature, featuring advanced hardware and software and making it out of the question for Teacher One to repeat what she had observed in her own classroom setting.

Equipment purchases and plans

Teacher One's classroom computer had been given to her by the Home Economics Department. The Home Economics department had bought an Amiga 2000HD and colour printer with a good range of imaging software for an investment of about $7,000. The computer was to be used in a fashion design unit but no one could figure out how best to apply it to the course. A visiting

exchange teacher from America first borrowed the Amiga for use in the art room and since that time, Home Economics had not requested its return.

Teacher One suggested that the unreliability of the Amiga and the fact that there was only one machine available for twenty-eight students had contributed to her lack of enthusiasm for working in the area. However, she was interested in getting access to an IBM machine. Prior to the interview, CorelDraw 3 had been installed on a computer in the manual arts block. Access to this program, for the personal use of Teacher One, had been arranged but she had found that locating the room key, walking down to the manual arts block and the process of starting up the computer left little time in a spare period for any constructive learning, therefore, this avenue of self development had not been taken.

Teacher One talked of the more promising possibility of gaining access to a laboratory of IBM compatibles. The laboratory was normally used for subjects such as Practical Computer Methods or Mathematics. While no specialist art software had been installed in the laboratory, 'Dr. Halo', a simple paint program was

available. Teacher One hoped to gain block access to the laboratory for her art classes for a period of about two weeks, however, this required the removal of classes normally scheduled. Due to the recent absence of the computer teacher, Teacher One had decided to wait until his return before continuing to pursue this arrangement. She had hoped to attempt a project in the laboratory such as designing the poster for the school musical. Unfortunately, the poster was needed before she had time to learn how to use the program herself, organise access for her class and then teach the students.

Current uses

At the time of the interview, the classroom computer was most often used as a reward system for individuals or groups of between two and five who had finished their work before the rest of the class. Teacher One commented that:

> They just play around on it, making pictures using either DigiPaint 3 or DeluxePaint 3, whatever they like - like free time.

Sometimes students saved images to disk but pictures they had created were never printed out. Mostly they were left to themselves to figure out how to use the programs through a process of trial and error. Teacher One indicated that she would like each student to have at least one attempt at drawing on the computer but did not wish to force reluctant students.

Student characteristics

Students in Teacher One's classes were generally very eager to use the classroom computer even though it was faulty. They often hounded Teacher One about getting access to the laboratory of IBM compatibles. Although this laboratory was occasionally available for student use at lunchtime, Teacher One considered it unlikely that her pupils used the facility then due to their lack of experience.

She noted that she was unable to use the software features on the Amiga as well as some of the members of her class and commented that not many of her pupils had computers at home. If a serious problem occurred with the software, students who

could be relied on to "trouble-shoot" had to be tracked down from other classes as most of them did not take art.

Helpful people

Staff at Teacher One's school were not negative towards the use of computers but at the same time, did not offer much in the way of positive discussion. Fortunately, however, a resourceful and enthusiastic technician worked at the school. Although his job description related mainly to the care and maintenance of the laboratory of IBM compatibles, he had not hesitated to offer assistance to art staff. More than once, he had relieved the teacher of the responsibility of dealing with repairers by taking the Amiga to be repaired. He had also made adjustments to the computer table to ensure stability and minimise wear on the cables and connections and was instrumental in the writing of equipment proposals. The technician was a key figure in Teacher One's experience.

Balmoral Design and Technology centre was also able to offer some assistance to Teacher One. The Centre was available for student visits. However, the difficulty of staffing, timetable

and travel arrangements were stated as reasons for not using the Centre.

Teacher needs

Teacher One's most pressing need, as she explained it, was for one-to-one tuition so that she could build her confidence with the technology and its features before making computer use a definite part of the art program. She considered the need for a new photography dark room to be more pressing than that of obtaining more computer resources. The art room was otherwise thought to be reasonably well resourced. In particular, the use of video resources were talked of as being convenient and enjoyable. The three adjacent art rooms shared their own video and television and so did not have the inconvenience of booking classes into the library or using up valuable class time moving students between the library and art rooms.

Teacher One: Action Cycle

The action sequence as described in Chapter Three, was designed around the teacher's stated need for one-to-one tuition

and her desire to relate computer learning experiences to real life tasks such as the creation of posters or newsletters. The achievement of this goal was facilitated by the arrival of an IBM computer for the teacher's personal use as well as the later discovery of an unused scanner. The technician's support was also instrumental in loading software and linking the computer with a laser printer located in the administration office.

The learning experience for Teacher One involved familiarisation with the complex text manipulation and layout features of Coreldraw 3. The numerous options available in the program and the speed with which text and graphics could be changed and manipulated meant that Teacher One was pressed to make scores of design decisions at every step of the creative process. Discussing these decisions was an enjoyable part of the researcher's experience. For example, choosing the type face to be used on the poster for School Arts Night required Teacher One to decide from over 100 electronic fonts. Decisions were made on the basis of how particular fonts and styles could influence the meaning of words. Some looked too sloppy, too neat, too bold or too authoritative to be appropriate for the poster. Boldness, size,

style, colour, pattern and shading also influenced meaning. Many alternatives could be tried and discarded in a short space of time. The researcher noted that roughly a dozen versions were attempted for any one exercise. Sometimes these versions developed sequentially as one idea led to another while at other times highly contrasting versions were tried in a process of clarifying ideas by elimination. As the weeks progressed and Teacher One became more familiar with fonts and manipulation effects, the number of versions tried before deciding was reduced to about three. Favourite fonts were repeatedly chosen and Teacher One developed a feeling for what effects would suit a particular job.

The various features of the program were difficult for Teacher One to remember from week to week and repetition was a necessary part of the work cycle. The manual was avoided and problems were usually left until the researcher's visit the following week. During the sessions, the achievement of a useful end product was important to Teacher One and the high quality print-outs she obtained from the administration office laser printer were a source of pride and excitement. Although the administration office staff had been helpful, greyscale images and

graphics took quite a long time to print and interrupted their work patterns. In order to keep good relations with the staff, it was necessary for Teacher One to arrange to ring the office before sending anything down the line.

The arrival of the scanner represented another rise in the learning curve for Teacher One. She had to learn about file sizes, image formats and methods of conversion. She also had to learn how to control the brightness, darkness and sharpness of the scanned image. These aspects of image manipulation were interesting to Teacher One as she had previously done photographic dark room work which mirrored these processes, although the more advanced features of image editing and special effects were not explored. This was attributed to the fact that the jobs Teacher One was asked to do for the school relied mainly on text design and layout and did not require photographic images. However, the researcher also noted that the teachers' familiarity with creating images in traditional media such as drawing or painting, overrode her desire to attempt such activities on the computer as the process seemed more difficult and inefficient. The scanner was used for such things as scanning a student drawing for the front

cover of the School Magazine and scanning images to be used in advertising layouts for the publication of the Queensland Art Teachers' Association.

During the researcher's visits, some interest in the computer was shown by one of the other visual arts staff but this mostly consisted of looking on in awe. This staff member indicated that when Teacher One was confident enough to be a successful role model and guide, she would be more likely to act on her interests. The third member of staff showed no interest at all. He had a very difficult class and extreme stress was evident in his behaviour. He gave the impression that he did not trust his students around such equipment and it would be a long time before he would consider using computers with his classes.

Teacher One developed considerably over the two months the researcher was able to observe and participate in her learning experiences. It was evident that ease of access to a suitable machine, repetition, working on practical tasks, visible outcomes and the researcher's presence were essential contributors to her feelings of success. Teacher One witnessed the ability of the

computer to allow artists to try out a variety of ideas in a short space of time, sparking discussion and facilitating the decision making process. The tasks Teacher One chose, however, were those which she considered would be too difficult or time consuming to do by hand. No link was made on a personal level between computer use and fine art practice.

Teacher One: Follow up Interview

A follow up interview was conducted with Teacher One approximately six months after the researcher's last visit. School numbers had continued to fall during that time resulting in the transfer of one of the members of the art department. Teacher One had been given the choice of taking two Social Science classes or also accepting a transfer. The generally low status of visual arts within the school had not improved and the current situation was partly attributed to this.

Teacher One felt that she had not been a very good candidate for the study because she had not been able to use her computer skills with students who had eventually given up trying

to use the classroom Amiga computer due to increasingly frequent breakdowns. The Technician then redistributed the computer's parts amongst other machines in the school. Teacher One had still not been able to arrange access to the computer laboratory as it was booked almost constantly and Mathematics classes were given priority. However, she had not given up trying. Her art elective class was currently doing logo designs and she was hoping that they could use the computer for that assignment so that they could produce more professional lettering and layout. Teacher One stated that she felt she had learnt just enough to get by in a laboratory setting. She felt the lesson would go well if the students were able to figure out some of the program features by themselves, so that her role could involve offering design and composition advice. In the meantime, she was considering allowing a few of her older students to use the staffroom computer to help in the creation of headings for the School Magazine.

The technology committee in which Teacher One had previously been involved had ceased to exist as the founding teacher had left the school. Teacher One had become an enthusiastic advocate for the use of technology in the visual arts

and said she would immediately join another committee, should one be formed. Teacher One's main stumbling block was laboratory access. She noted that due to the fact that Desk Top Publishing was part of another course at the school it weakened her case for getting art students involved. She stated that:

> If we could get into the computer labs and use that as part of art for one of our electives and to help produce the School Magazine it would really pick our subject up.

Teacher One had continued to use the staffroom computer for odd jobs such as worksheets, handouts and posters and was sometimes asked to scan pictures for other staff members. She had not kept a record of any of these jobs and commented that if she was given enough warning she enjoyed helping but hoped requests did not increase because of her limited time. It was sometimes difficult for Teacher One to remember how to use the computer after holiday breaks but because most of the tasks she was asked to do were of a repetitive nature she had managed to get by. The technician was reported as sometimes using the computer for "interesting jobs" such as producing maps but the other member of the art staff had been too busy to learn. In some ways,

Teacher One liked being the sole user because it meant that the computer was always available when she needed it.

Teacher One had not attended any workshops since the researcher's visits but was aware of a two hour CorelDraw workshop that might be coming up. Teacher One was also considering arranging a computer inservice course for teachers at her school in the following year. The inservice would be run by a visiting expert and would take place on a pupil free day. She hoped to attract 10 or 12 participants.

Overall, Teacher One considered that her enthusiasm and confidence had increased sufficiently to allow her successfully to conduct classes of a graphic design nature in a computer laboratory setting. She stated that she still could not connect computer use with her specialist fine art areas but was aware that some artists did use computer print-outs in their paintings as collage elements.

Teacher One: Researcher's Reflections

Teacher One's acknowledgment of her needs resulted in them being met through help from the researcher and the generous assistance of the school technician. At first, the researcher was concerned that focusing purely on the teacher's needs without giving thought to the current situation of her students would not be likely to meet the study's goal of exploring the enrichment of visual arts education. However, this fear proved unfounded as, throughout the course of the study, Teacher One integrated the use of technology into her work routine in such a way that her improved confidence and skills would ensure benefits for her students in the long term. This positive outcome highlighted the importance of focusing on the teacher as a key player in the successful implementation of technology.

The results achieved by Teacher One could be attributed to three main factors. Firstly, the critical mass of good quality equipment that arrived during the course of the study and its location in the art staff room was fundamental to Teacher One's success. Ease of access and the reliability of the equipment

minimised problems for Teacher One and encouraged more frequent use. Secondly, allowing Teacher One to follow her interests instead of performing a set of tasks predetermined by the researcher was a successful motivational strategy. Her high involvement in the tasks assisted in the transfer of skills. Thirdly, frequent requests from fellow staff for posters and flyers resulted in the repetition of tasks which greatly improved Teacher One's retention of the skills she had learned.

Although a level of success had been achieved during the action cycle, Teacher One's comments indicated that she held the perception that computers were mainly applicable to graphic design activities and that she expected computers to be efficient, time saving devices. It became apparent to the researcher that, although Teacher One believed that computers could be used to enrich visual arts education, she was not yet aware of the many wider possibilities for enrichment or the specific steps involved in realising those possibilities.

CASE STUDY: TEACHER TWO

Teacher Two: Beginning Interview

School Two profile

School Two was a Private Girls' school located in a well established suburb of middle to high socio-economic standing. The school catered for the full range of high school grades and was conscious of its good reputation amongst the local community. Public displays of school achievements were important to the school's senior administrators. Events such as sporting competitions, musical and dramatic performances and the annual art exhibition were significant social occasions and frequently appeared in the weekend newspapers.

The art Department consisted of Teacher Two and one other female teacher. Teacher Two considered the other teacher not to be interested in technology and generally uncommunicative. She noted that the school environment, whilst not negative towards the visual arts, had a generally low awareness of their activities.

Teacher Two profile

Teacher Two had been a high school visual arts teacher for approximately twelve years. At the time of this interview, she had been in her current appointment for approximately two and a half years. She had not been exposed to computers prior to starting at this school and felt that she couldn't afford to have a computer at home for personal use.

The teacher who had held her position previously, had purchased the classroom computers and received six months support and training from the suppliers. However, Teacher Two had to rely on tuition from the Year Twelve girls with whom that teacher had worked. This placed Teacher Two in an awkward position as these girls behaved ungraciously in their role as tutors. Teacher Two found she was not in contact with other art teachers who used computers and her attendance at previous computer workshops had not resulted in any activities that she could transfer to her classroom setting due to lack of equipment and experience.

Teacher Two considered her speciality areas to be painting and drawing but stated that she lacked the time to update and practice her skills. She considered her role as a teacher to be more important than that as a practising artist.

Teacher attitudes

Teacher Two expressed anxiety about being left behind by computer technology and stated that she felt like an outsider. She felt pressured to be seen to be using technology. In particular, she commented that the Private school environment meant that "you couldn't be seen to be doing the same thing year after year". An expectation was placed on her "to be seen to be advancing and using all the facilities." She stated that:

> I almost feel like its a case of taking every opportunity to find out more about computers so that you're not caught on the back foot.

Teacher Two was aware of the role that technology played in the lives of students and commented that "a lot of relevance would be lost" if art couldn't contribute in that area. She considered computers to be just another medium for students to

explore like painting or ceramics. She also acknowledged the potential of technology to lift the status of the arts and commented that:

> When they see that the art department has computers, well, they're quite impressed.

She described her approach to teaching technology as a process of "learning tricks and repeating them" and stated that "with kids its a great thing to be able to do something starry". If she could impress students with her ability to use a particular software feature it would keep them busy for some time. She had an unwritten policy of trying to concentrate her energy on younger students so that they could contribute as peer teachers in the following years. Teacher Two considered it a waste of time to invest too much energy in the older students who would soon be leaving the school and taking their knowledge with them.

Teacher Two believed she had a problem-solving approach to learning about the computer and chose to use it for specific, predetermined tasks, only going to the manual when all else failed. She stated that she treated computers with a great deal of respect

because she was afraid of damaging them by wiping the hard drive. If a technical problem arose, she felt at a loss and didn't know what to do other than turning the computer off.

From attending the workshop, Teacher Two commented that she realised that the potential for computer use was totally limitless and that whole units of work could be made available on the computer such as colour and design questions and exercises. She thought that it would be good to put together a test on surrealism but having the time and the confidence to undertake such a task was beyond her current abilities.

Equipment purchases and plans

Five Amiga computers and a Hewlett Packard 500c colour printer were purchased for Teacher Two's classroom by the previous teacher through funds provided by the Parents and Friends Association. Further equipment purchases would be made through the art budget but no plans were in place at the present time. Teacher Two thought that the Parents and Friends Association could be asked again to contribute to computer related expenses, especially around such times as the Annual Art Exhibition. Teacher

Two commented that it had taken nine months for a switch box to be purchased that would allow all computers to connect to the printer without recabling. At the time of this interview, the switchbox had not yet been connected and one computer was not working.

Current uses

Computers in Teacher Two's classroom were occasionally used for graphic design exercises such as creating a company logo or experimenting with monochromatic and complementary colour schemes. Typically the whole class would begin with traditional media such as paint and paper and the first students to finish would then be given the opportunity to reproduce their designs on the computer. Further design experiments such as pattern creation through repetition were also encouraged. Teacher Two stated:

> I think that's a legitimate use for computers, when students can quickly build up fields of colour and not have to sit down and paint them all before being able to compare them.

Student characteristics

Teacher Two considered her students to be independent thinkers although she found some of the older girls quite arrogant at times. She estimated that over half her students had access to computers at home but commented that these machines probably did not run art software. Students enjoyed using the computers to make patterns and designs but were not overly enthusiastic.

Helpful people

Teacher Two had employed the help of a tertiary student she had met to run computer workshops and after school courses for interested students. The tertiary student was majoring in computer art using Amigas and had worked at the school as an 'Artist in Residence' for a brief period. She was the main person Teacher Two could turn to for help is she ran into difficulty. However, while Teacher Two was pleased with her input, she felt that because the tertiary student was not a teacher, the classes were sometimes not conducted in the way she wished. She commented that the tertiary student tended to do the work for the girls and aimed at getting sophisticated results too quickly for students to learn the basics. The Head of the Computer Department

was considered helpful but did not know much about problems specific to Amigas. Suppliers were found to be generally unhelpful, unreliable and slow to return equipment after repairs.

Teacher needs

Teacher Two felt confident that she had enough understanding of computers to get by in classroom situations but that her main frustration was with not knowing how to relate computer work to the Junior and Senior art programs. She expressed a feeling of isolation and the need to talk with other art teachers about ideas for units of work using the computer. She felt that some of her ideas for using the computer probably did not take advantage of what they could do best. Teacher Two had not attended many computer workshops. Those she had been involved in usually involved the demonstration of sophisticated software or hardware features that were difficult to repeat in her classroom setting.

Teacher Two: Action Cycle

The action cycle negotiated with Teacher Two aimed at linking the computer to the current unit of work for year 10 girls. The unit of work focused on developing a sequence of drawings in a variety of media which might contribute to a drawing portfolio or culminate in a major work. Two groups of five students volunteered to take part and worked with the researcher on alternate weeks. These interactions took place in the art room where other students were working on drawings, painting and clay work in the presence of Teacher Two.

Teacher Two and the researcher considered that a major factor contributing to the computer's lack of integration with the curriculum was the need for an input device such as a scanner or framegrabber. Such a device would allow students to create digital files from their drawings and other artworks that could then be manipulated with the image editing software already available. One way for classrooms without such facilities as scanners or framegrabbers to get around this situation is to have this part of the process done elsewhere. Therefore, the researcher arranged to

videotape the students' preliminary works and framegrab them at the Queensland University of Technology. Once the images were transferred to disk, they would be returned to the students for further manipulation and experimentation.

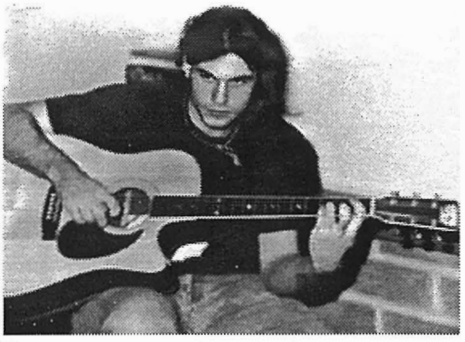
The preliminary images chosen for this exercise by the students represented a wide range of starting points as shown in **Illustration 4**. Some students began with images of paintings and mixed media collages they had created previously. Others chose to begin with print reproductions of their favourite artworks, photographs from magazines or snapshots. Two of the students began by draping themselves in red curtains and posing for the video camera. Another student planned to explore a quite complex theme concerning teenage suicide. The digital files created from the taping session were met with excitement upon their return. In some instances, the results were surprising when displayed on the computer screen. Images thought to be poor choices during taping turned out well and *vice versa.* Students noticed changes in image quality typical of digital files on the Amiga such as colour variations, flaring, loss of detail and changes in scale.

Illustration 4

Starting Points for Image Development from Framegrabbing Experiments (Teacher Two).

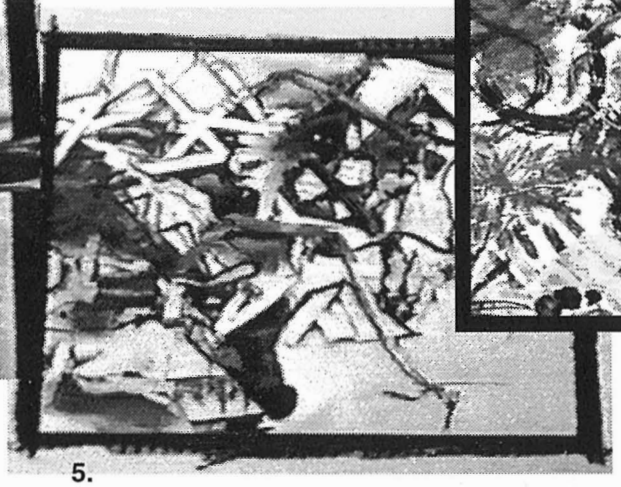
1.

2.

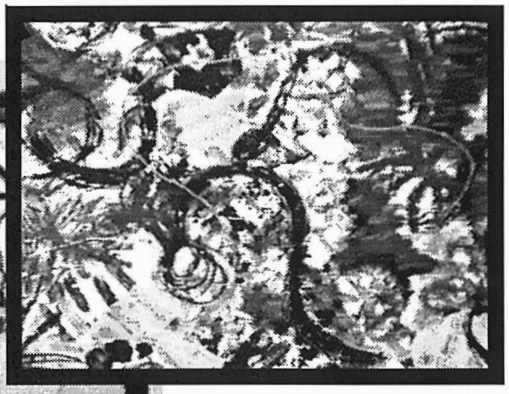


3.

4.



5.



6.

7.

8.

Using a video camera, students recorded starting points for image development to be framegrabbed later at an outside facility. These starting points included images from magazines, books and personal photographs (1, 2, 3); drawings and mixed media works from student portfolios (4, 5, 6) and self portraits posed for the camera (7, 8).

During the next sessions, students were encouraged to experiment with their images, saving each variation as they progressed. Usually they chose to play with colour palettes or special effect features. The results were unusually bright and contrasting images or pictures distorted into spheres and other shapes. Some of the participants lost interest in the project after this initial period of experimentation. They seemed not to know how to take their image further or were satisfied with the file as it was and did not make any changes. Others persevered and created unusual and rich images that combined several advanced features of the software. Occasionally, the computers would crash and require rebooting or files would corrupt for no apparent reason. This was a frustrating aspect of working with the computers for all concerned and resulted in a lack of momentum and a discontinuation of some works. Unfortunately, none of the students used their experience on the computer to stimulate work in other media. Instead, most seemed satisfied with screen output or the occasional print-out.

Student attendance during the researcher's visits was irregular as friends flowed in and out of the computer area,

interrupting participants by asking advice on art projects or unrelated events. The nature of other art activities taking place in the room also encouraged a lot of student movement and contrasted with the seated concentration of the computer group. At the beginning of each session, Teacher Two had to make the effort to round up those students who had promised to take part. This was complicated by the alternate group arrangement and other activities which resulted in disruptions to attendance such as the School Camp. During the sessions, the teacher became indirectly involved in the researcher's visits by offering encouragement to the students, giving advice on aspects of design, looking at how software features worked and taking part in the printing process.

Overall, the results of the researcher's participation in the classroom had served to improve the skills of students and stimulate some interest in the more advanced features of the software. Whilst using student works created in other media as the starting point for computer imaging had made a link between the technology and the curriculum; further work was required on this project to take it through to a successful conclusion. Students needed to have framegrabbing facilities available in the room so

that the teacher could model the use of the computer as a diagnostic tool during the work cycle. Teacher Two also needed permanent access to these facilities in order to refresh her own skills so that she could assist students further and experiment with other uses.

Teacher Two: Follow Up Interview

A follow up interview was conducted with Teacher Two approximately six months after the researcher's last visit to the school. At this time, little had changed in the art classroom regarding technology use. No new hardware or software had been purchased for the visual arts department or was being planned for purchase. Teacher Two had not attended any further computer workshops. Computers were still suffering occasional breakdowns and continued difficulties with repairers were reported. Teacher Two stated that she had recently been impressed by brochures that arrived at the school advertising image editing software used on the MacIntosh and was considering moving in that direction. She commented that she thought if was important for students to gain

experience using the MacIntosh platform for two reasons. Firstly, the MacIntosh computer was able to show a much more detailed picture on screen, allowing accurate and precise work and secondly, the MacIntosh computer was considered to be the industry standard. Adopting a MacIntosh platform also meant that Teacher Two could expect support and assistance from the computer coordinator.

Employing the help of skilled artists to run after-school workshops was still a preferred option for Teacher Two. However, she had decided not to work with the tertiary student she had talked about in the first interview. Teacher Two stated that she was interested in "doing something showy" with computers at the next Annual Art Exhibition. She had in mind a performance piece in which images could somehow be projected from the computer onto a larger screen. The researcher was able to refer Teacher Two to a performance artist and computer engineer who was available to run a short series of workshops and who would be able to help her realise this idea.

A discussion with the artist who conducted these workshops revealed that he found the students to be overconfident

at times. He commented that they often considered that they knew how to use the computer well when really they had only begun to "scratch the surface" of its capabilities. This attitude made teaching difficult at times. He frequently brought in reproductions of computer based art works from magazines in order to broaden their concepts about the medium and encourage them to extend themselves. For the Annual Exhibition, students created transparencies from their computer images and projected them using an overhead projector. The display formed part of a parade of experimental costume designs created by the students and modelled on the opening night.

Teacher Two: Researcher's Reflections

Teacher Two showed good instincts and an active imagination in considering possible ways to enrich visual arts education through the use of computers, although she rarely had the necessary skills to realise her ideas completely. Teacher Two compensated well for this situation by trying to attend workshops herself and by regularly employing the help of visiting computer artists. Considering the difficulties involved in implementing

computers for teachers with no previous computer experience, the use of visiting artists or experts is a worthwhile and inventive strategy. However, it is worth noting that the visitors' expertise mainly benefited the students and is not likely to improve classroom practice significantly for the teacher who may not have sufficient confidence to carry on their work in the classroom. The visiting artists' lack of teaching techniques can also cause further problems and prevent student progress.

Unfortunately, the action cycle negotiated with Teacher Two followed a similar pattern of using the skills of an outside expert to benefit students instead of the teacher. Teacher Two was able to look over the shoulders of the students during the researcher's visits, and see the progression of their work but was unable to participate directly due to her other classroom responsibilities. This factor and the classroom's lack of an input device meant that it was unlikely that Teacher Two would be able to repeat the project on her own. Therefore, the benefits of the researcher's intervention could be said to be mainly that of awareness raising and familiarisation with the processes involved in the approach. Hopefully, the potential revealed by the exercise

might inspire Teacher Two to continue her efforts to obtain a framegrabber or scanner for classroom use.

Teacher Two's interest in stand-alone educational software for use in the visual arts highlighted an important avenue of help for visual arts teachers that has not yet been fully explored. The use of educational software would not require the teacher to be an expert user. Students and teachers could experience successful classroom activities. Good quality educational software would also facilitate curriculum integration. It is unlikely, however, that such software will be developed for the Amiga platform and it may be necessary for teachers to invest in other types of computers such as IBM or Macintosh in order to take advantage of new titles.

The time spent participating and observing in Teacher Two's classroom was an enlightening experience for the researcher. Working with the students brought home the point that teachers need to have not only practical but also critical understandings when using technology in visual arts education. Obviously, practical understandings are essential to enable the teacher to operate the hardware and software, but critical understandings are

equally important as they empower the teacher to take advantage of the characteristic qualities of the computer as a creative medium. By naming, defining and evaluating the use of such qualities as randomness, light and seriation, the teacher may be able to turn initially disappointing outcomes into worthwhile educational experiences for students.

CASE STUDY: TEACHER THREE

Teacher Three: Beginning Interview

School Three profile

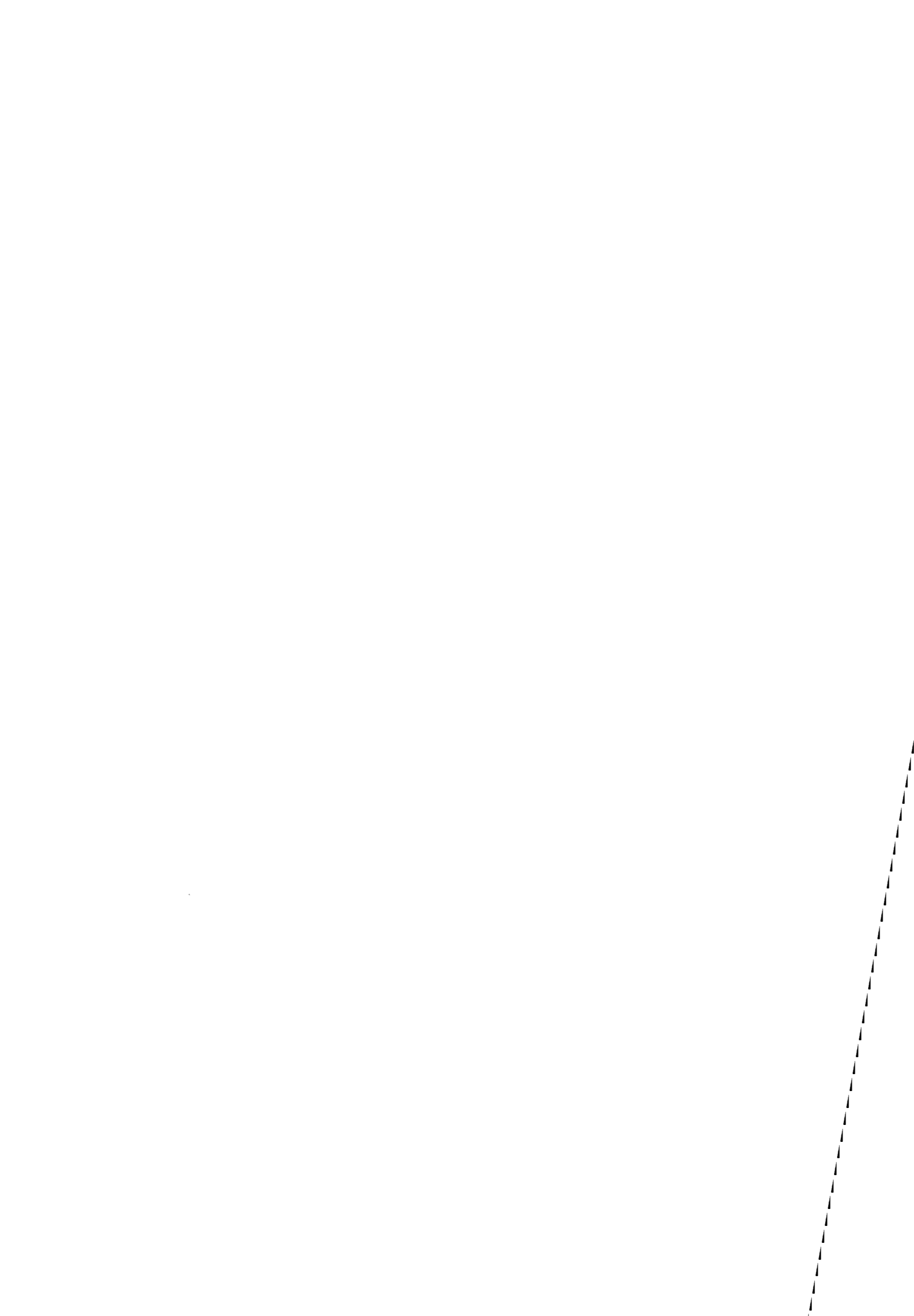
School Three is located in an area where the development of new housing estates has led to increased population growth. At the time of the study, student numbers had increased at the school resulting in large class sizes and extremely busy staff. The art department consisted of three teachers and a part time teachers' aide. Teacher Three was the main user of computers but other staff had made efforts to incorporate technology into their programs. The Principal was noted for his particularly 'jaded'

attitude towards computers having faced many expenses in the past for technology which was now obsolete.

Teacher Three considered that art definitely had a low profile within the school and she noted that students avoided taking the subject. She wasn't sure what caused this situation but explained that the art department made students work hard for their marks and didn't take a "playtime" approach to the subject area.

Teacher Three profile

Teacher Three had been teaching in the visual arts for seventeen years. Her speciality area was painting and prior to working at this school she had no previous experience with computers. However, she had been active in learning about computers and had had an Amiga computer at home for about five years. She claimed that she "had to buy one to use at home to learn for school". The home computer was used mainly for the preparation of task sheets and rarely used for creative artwork of a personal nature. Although Teacher Three recently upgraded her



computer, she had also ordered the latest model in the Amiga range and was awaiting its arrival.

Teacher Three stated that she had attended as many inservice courses and workshops as she could find. They varied in length from a single evening to one night a week for six weeks. She commented that courses which started with the basics were quite frustrating because it meant she spent a lot of time waiting around before learning something new. Other courses involved brief introductions to a number of different types of software and were of little help upon return to the classroom as there was no time to practice or expand on what was shown. Teacher Three believed that time shortages had contributed to a lack of interest in computers by other teachers in the art department. On a positive note, however, Teacher Three found that attendance at a variety of courses had resulted in some networking benefits. She commented that she was aware of what most other teachers were doing in her region and could call on them for help if she really needed it.

Teacher attitudes

Teacher Three was motivated to use technology because she was aware that art students needed some experience with computers in order to make the best of tertiary education and employment opportunities. She found that students who couldn't handle traditional media well, often excelled on the computer and stated that it was a useful tool for them. She considered that student progress had been slow in relation to technology and a lack of integration with the curriculum was also reported. Overall, Teacher Three was disappointed with the outcomes of computer work when compared to the time and expense they incurred. She stated that:

> I think if it was left up to me and we didn't have the kind of pressure that we have now to get kids on line, I would give up using computers quite happily - simply because they take up so much time and so much money.

Teacher Three believed that she had a good understanding of word processing packages but only a fair understanding of paint packages such as Deluxe Paint 4. She described her approach to learning how to use software as experimental and found that she

only consulted the manual if she had been stuck on a problem for a long period of time.

From participating in the researcher's workshop, Teacher Three had a positive attitude towards the use of multimedia authoring packages such as AmigaVision. She commented that they would be a good way to prepare lessons although noted that it would be "next to impossible" to have sufficient time to do that. She thought it would be more likely for students to use the program for assignments such as one she had planned that involved making an art teaching resource. She also considered that AmigaVision would be good for presenting sequences of images that students had transformed on the computer. It would be appropriate for presenting screen-based creative works and would allow students to add text that discussed the focal points and relevant aspects of their designs.

Equipment purchases and plans

Due to the Principal's desire not to be involved in the frustrations associated with computers, all responsibility for equipment purchases, repairs and maintenance had been passed on

to the individual departments within the school. This move had created extra work and responsibilities for Teacher Three who was constantly communicating with suppliers about repairs and trying to decide on the best direction for her department. At the time of the interview, two computers and the camera used for digitising were out of order. Despite repeated calls to the service shop over a number of weeks the camera had still not been returned. Maintenance expenses were a regular occurrence and Teacher Three commented that:

> ...its a bit frightening when you get bills for repairs every week for $350.00.

Teacher Three had plans to upgrade one of the classroom computers to the latest model, an Amiga 1200, and also wished to purchase an IBM so students could work with programs such as Coreldraw 3. Classroom space was already limited however, and Teacher Three was unsure how to overcome this problem. One idea was to organise a computer laboratory for the shared use of visual arts, manual arts and music but so far this suggestion had met with

no response from the Principal, even though the other subject areas were willing to cooperate.

Current uses

Current use of the computers in Teacher Three's classroom was mainly for graphic design projects. Year 10 had been using Deluxe Paint 4 to design a Music CD cover. Teacher Three commented on the difficulty of having only 10 computers available for a class of 30 students. She stated that :

> You have to allow students to use it on their own while other students are doing something else. You are rarely ever there, actually watching what's going on or to take them through something.

On one occasion, Teacher Three had students use the security camera to digitise an image and then, using Deluxe Paint 4, create a series of image transformations. Firstly they were asked to trace over the image to show implied lines and next they were encouraged to experiment with colour schemes by reducing the colour palette from the standard high resolution computer palette of 4,096 colours down to a palette of only 12 colours. Some students had also been using the animation features of Deluxe Paint

4 and Teacher Three noted that the instructional videos which came with that package had been really useful. Some students had digitised images for use in assignments but generally the computer was not used for solving problems or developing art work in other media.

Student characteristics

Most students at Teacher Three's school were really eager to use the computers although a few had lost interest after initial experiences. In particular, boys showed the most interest and enthusiasm. Many students had computers at home but these were not used for artistic purposes. Teacher Three commented that a lot of students would have liked to continue working with the computers after completing the projects she had set, but the class had moved on to other work.

Helpful people

The computer coordinator at the school was considered helpful by Teacher Three but did not know anything about Amigas. Teacher Three commented that:

> I'm left on my own to coordinate our computers simply because she doesn't have an understanding of Amigas.

The only other avenue of help available to Teacher Three was through suppliers. She commented that she generally had good relationships with computer suppliers but dealerships frequently closed or changed hands leaving her on her own again. Teacher Three was hoping that she would be able to get a young computer animator to visit the school as an 'Artist in Residence' to help both her and the students but as yet, this could not be arranged.

Teacher needs

At the time of the interview, the art budget was quite well financed and so, in many ways, Teacher Three felt that her classroom needs were well met. However, use of existing equipment and the purchase of any new equipment was limited by

the lack of available space. Apart from this dilemma, Teacher Three considered that lack of time was her biggest obstacle. She didn't have enough time to learn about new software packages or practice what she already new. She was also unable to spend enough time working with students during class as her attention was always divided between the computer annexe and other class activities.

Teacher Three believed that using the researcher's expertise to work with a group of students on an AmigaVision project would have five main benefits. Firstly, it would model the creation of an AmigaVision project to the teacher and so familiarise her with the steps needed to organise and complete such a project on her own. Secondly, it would familiarise students with the requirements of a multimedia presentation so that they might assist the teacher and other students when next they attempted such a project. Thirdly, the researcher's presence would provide the students with some uninterrupted attention and tuition not normally available during class time. Fourthly, Teacher Three hoped that exposing students to such a project would motivate them to take visual arts in the Senior years and lastly,

she hoped that the presentation of a computer project at the School Art exhibition would be good publicity for the art department.

Teacher Three: Action Cycle

The action cycle for Teacher Three involved taking a group of twelve students through the process of creating an interactive multimedia presentation. The rotating schedule of school visits previously discussed in Chapter Three meant that the teacher was present during the researcher's visits on only a few occasions. On the remaining visits, other members of staff were present or the room was empty. The action cycle began with a meeting of the 12 participating students and the researcher to discuss multimedia presentations, decide on a suitable topic for the project and allocate roles. The students came from five different classes and responses revealed that they had not been exposed to interactive multimedia as such although some students, mainly boys, had played arcade games. This factor made it difficult for students to imagine the end product and so contributed to a lack of motivation.

Out of several possible topics, a theme which explored animals in art was mutually agreed upon. Brainstorming around the topic revealed several aspects worthy of exploration such as animals in famous art works, animals in popular culture, how to draw animals, wildlife photography and animals in movies. The need for the program to have an introductory and concluding sequence was also discussed. From this pool of ideas, students nominated an area of interest and these nominations resulted in four groups of three students. Three boys constituted the 'Animation Team' whose responsibility was the creation of the animated introduction and credits. Three girls made up the 'How To Draw Animals Team' and a mixture of boys and girls contributed to the 'Fine Art Team' and the 'Popular Culture Team'.

At the beginning of the following session, students were given hand outs which clarified the previous week's discussions. These handouts included an outline of the project goals, a flow chart, a list of team members and a description of team tasks and responsibilities. The rest of that session was spent familiarising students with the available paint and animation software. It was interesting to note that while all students had used paint software

before, they had forgotten a large proportion of what they had learned. Apart from an initial familiarity it was like starting all over again. Forgetting how to use software was attributed to a number of factors such as the length of time since students last used the computer and the lack of task repetition. Another factor contributing to poor retention of software features might have been the experimental or accidental way in which students taught themselves. Sometimes students could not remember how they achieved a particular effect directly afterwards because the effect had resulted from a complex series of spontaneous choices and accidental combinations.

The first responsibility students had after the initial negotiation and familiarisation sessions was to locate photographic or three dimensional resources that could be used to form the image base of the project. This required students to spend time in the library, or collect objects from home and bring them to the next session. Unfortunately, this presented a problem for some students who failed to collect any resources for input. Students had not found the handouts a useful reminder and generally did not take their responsibility seriously. Lack of

reminders during the week, unfamiliarity with the researcher and rotating session times possibly contributed to this situation. It was also likely that lack of experience in creating multimedia presentations made it difficult for students to become enthusiastic or realise the importance of this step in the process. However, the best was made of the images that did arrive and a last minute scavenger hunt around the classroom resulted in some useful posters and books. The resources thus collected consisted mostly of print reproductions of famous paintings and ancient relics and 'How to Draw' books. These were videotaped by the researcher with the help of two students while the rest of the group continued to experiment with the available paint software. Since the classroom digitiser was still under repair, the images were later framegrabbed by the researcher at an outside facility.

The following week, the framegrabbed images were returned to the students. Each of the content teams had to select the images they liked best, edit them, choose titles and text and plan screen layouts. At the end of the session the images were saved to disk and returned to the researcher for storage. This pattern of work continued over the next few sessions. Meanwhile,

the animation team continued to work on the program's introduction and conclusion. The team began with a complex plan for the introductory sequence which involved a framegrabbed image of a forest path as a backdrop to a variety of animated cartoon characters. However, this plan proved too difficult and was eventually abandoned. Fortunately, the team was led by a student who had access to an Amiga at home and was an experienced animator. His guidance was invaluable to his fellow team mates who looked forward to learning about animation under his guidance. The less experienced member of this team sometimes expressed frustration at not knowing enough to really contribute to the development of the animation but despite this, the team showed enthusiasm and perseverance. Not only did they attend all the scheduled sessions but on occasion they arranged access to the computers at lunchtime in order to continue working.

Amongst the other three teams, such enthusiasm was not shown and occasional absences from the sessions were noted. In some instances, students informed the researcher that they did not attend a particular session because they were missing important work in their normal class and on another occasion some said they

were misinformed about the scheduled meeting time. Other difficulties the researcher experienced involved the computer space itself which was cramped and uncomfortable and often quite noisy from activities going on elsewhere in the classroom. There was little elbow room between computers and it was difficult for students to work together at the one terminal simply because of lack of room. Although there were ten computers, equipment malfunctions meant that only seven or eight were available at any one time. This meant that each week between three and five team members were unable to work at a computer and instead squeezed around one computer and tried to help. This did not present too much of a problem as three of the girls were decidedly uninterested and preferred a hands-off approach.

Motivation amongst all the students began to rise towards the end of the project. Completing the project involved transferring each screen design to the hard drive of one of the more reliable computers and programming the screens into a sequence using AmigaVision. The researcher was mainly responsible for this part of the procedure although one of the female students watched and helped in the decision making. When the series of screens was

previewed, students could see, for the first time, how the final product might look. Energy levels rose amongst the students and those who were slow to complete their work were suddenly eager to finish so that they could have their screens included. As the screens were shown, students began to notice how they could improve text and layout or add more images to the sequence in order to enhance the meaning of particular sections and offer something interesting to the viewer. This process of refining the presentation is an essential part of working with multimedia and had a unifying effect on the student group.

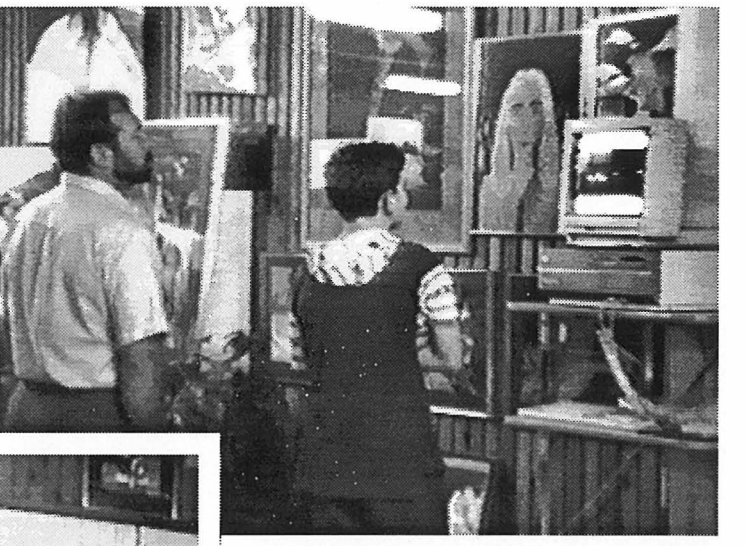
The addition of the animated introduction and sound effects was an exciting moment. The animation team had done an excellent job. The introduction consisted of a humorous cartoon dog who, while walking across the screen, was squashed by the title “Animals in Art”. The dog later appeared with bandages and crutches. AmigaVision was the first program the students had used which allowed sound effects to be added to an animation. The results were particularly pleasing to the animation team. The concluding sequence consisted of the names of each team member and framegrabbed images of some students to which were added

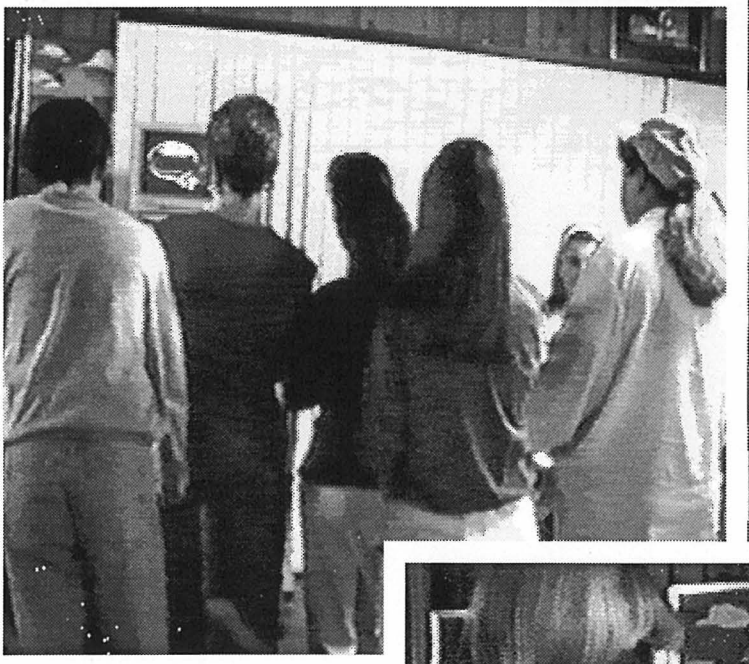
fictitious professional titles such as 'Script Editor' and 'Special Effects Designer'. The final multimedia presentation functioned much like a slide show with sound and was held on the hard drive of the computer while a second copy was saved onto three computer disks as a backup.

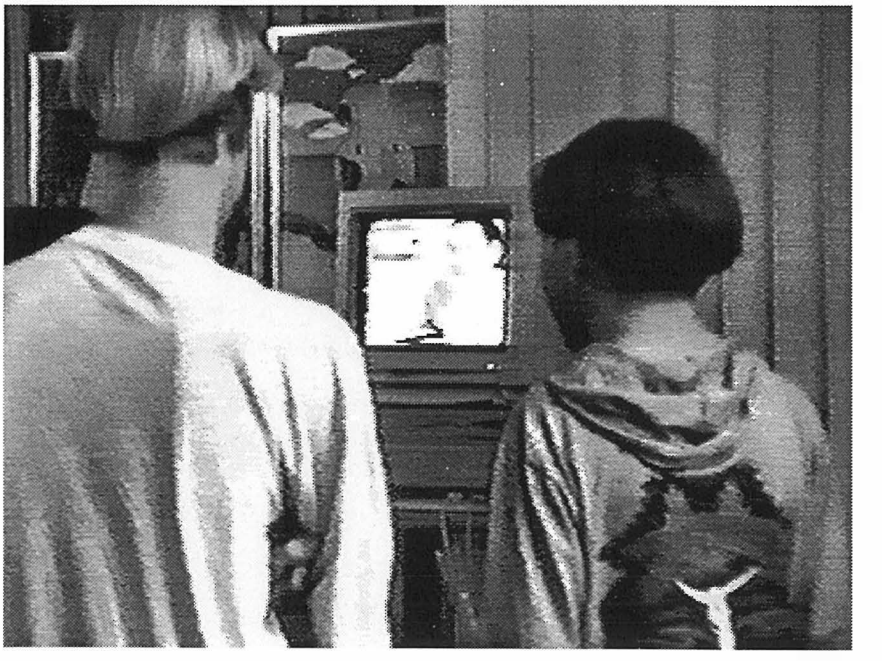
The computer had to be transported to the off campus site of the Annual Art Exhibition which was held in a community hall one suburb away. The Exhibition, as shown in **Illustration 5**, consisted of a considerable display of paintings, drawings, photography and ceramics but no computer based art works other than the multimedia presentation were on show. The Opening Night was catered for by the Home Economics students and the large attendance and success of the evening was a credit to the energy and professionalism of the art staff. During the evening, many visitors stopped to watch the multimedia presentation and noted that it added a new dimension to the gallery event. Five students who contributed to the creation of the program attended the opening and seemed pleased, although a little shy, with the results.

Illustration 5

Presentation of Multimedia Program at Annual Art Exhibition (Teacher Three).







The multimedia presentation, "Animals in Art" produced by students at School 3 was shown at the School's Annual Art Exhibition. It was the first time a computer based work had been included in an exhibition and the presentation drew a lot of interest from crowds on the opening night. Members of the animation team, right, look at the results of their labour.

Follow Up Interview

A follow up interview with Teacher Three was conducted approximately six months after the researcher's final visit to the school. Teacher Three had experienced delays in her efforts to purchase new equipment for the art department. Available funds had been severely reduced since the last time the researcher had spoken to the teacher. Suppliers had not yet responded to her personal order for an Amiga 1200 placed months earlier and dealer unreliability had complicated budget planning. Money was allocated to the art Department depending on how many courses were filled. If equipment was ordered for a particular course and then did not arrive it presented Teacher Three with a very inconvenient situation.

Teacher Three considered it unlikely that the planned purchase of an IBM and scanner for the art room would go ahead due to funding problems but an IBM was still intended as the next major purchase. There had been no further response from the Principal about the possibility of sharing a laboratory with manual arts and music. However, the library had ordered the 'National Gallery of

Art, London' CD-ROM (Microsoft, 1993) and Teacher Three was looking forward to using that with her students and ordering other titles as she became aware of their availability.

Lack of time was still considered one of the most inhibiting factors for Teacher Three who believed that student work would improve considerably if she had more time to spend with students during class. Working in a split group situation was not a preferred method of teaching but little could be done about that in the current classroom setting. The instructional videos that came with Deluxe Paint 4 were still relied upon by Teacher Three to assist the computer group while she managed the other students.

The framegrabbing facility had finally been restored to working order and Teacher Three related a successful project she had recently completed which involved students using a framegrabbed self image to prepare a design for screen printing. Teacher three stated that she liked to encourage the use of the computer for writing assignments and particularly for framegrabbing images that were being discussed in the text.

Enlarging the details of artworks on the computer was useful for analysis and considered to be a cost saving and time saving practice.

AmigaVision had not been used at all since the researcher's last visit but Teacher Three was still considering possible applications. She stated that:

> From the project we did, I think the students are more responsible in themselves. They obviously became incredibly enthusiastic towards the computer.

She commented that the students who participated in the research project had not had access to the computer since that time but she hoped they would be eager to use them again the following year. Teacher Three believed that the research project had been instrumental in developing "a team of people who could work together and perhaps who may be able to teach other people". Unfortunately, one of the key members of the animation team had decided to take accounting instead of art in the senior year. He told the researcher that his parents convinced him that there were more job opportunities in that area.

Teacher Three's ideas for future multimedia projects involved another cross collaborative effort. She discussed the idea of delegating different tasks to years 8 and 9 and relying on a year 11 group to sequence the resulting images and present them using AmigaVision. She preferred a process-based approach to using the computers rather than an outcome orientated one and commented that:

> I think its important that they start using the computers not necessarily to have outcomes but just to become familiar with the way it works, the way its set out and the types of things its capable of doing.

Teacher Three still found that networking was her most useful way of finding out what was happening with computer technology in her area. She found magazines, especially those for the Amiga computer focused on games applications and advertising and were not very informative for her purposes. Teacher Three had still found little use for technology in her speciality area, painting. She attributed this mainly to lack of time and faulty technology and stated that the equipment needed to be running smoothly so that there was an immediacy of results in order to facilitate the types

of activities she had in mind. Teacher Three mentioned a drawing she had done a few years earlier which she considered framegrabbing and using to experiment with colour separations. Her personal explorations could then be transferred to the classroom.

According to Teacher Three, an ideal professional development strategy would involve her personal speciality area, painting, in some way. However, since computer technology was a greater needs area she considered that a priority. She believed that improved practice would result from professional development which took place in her classroom on a regular basis and involved herself and at least some of the students. Teacher Three thought that by involving the students as well, she would be sharing the visiting expert's knowledge across a wider base, therefore ensuring success in future projects. The visiting expert would be able to relieve some of the pressure placed on Teacher Three to learn about the software in her own time. If the teacher and the visiting expert could design projects together and complete them in class it would provide a successful, repeatable experience for all concerned.

Teacher Three: Researcher's Reflections

It was evident from the researcher's experiences in Teacher Three's classroom that a great deal of time, effort and money had been spent in trying to utilise computers as part of the art curriculum. Teacher Three's attempts had been systematic, well thought out and aimed at benefiting the whole art department, not just her own classes. She had relentlessly pursued computer suppliers for both purchase and repair of equipment and had worked hard to push students to complete challenging projects using technology. Despite these efforts, Teacher Three had still met with very discouraging outcomes which resulted in her feeling as though her efforts had not been worthwhile.

Upon reflection, it is possible that Teacher Three may have benefited from investing less in technology and more in her own professional development. A better understanding of not just how computers could be used but how they could be used in an art teaching situation may have served her well. More rewarding experiences may have resulted from shifting the focus away from 'keeping up with technology' towards improving the quality of

classroom teaching and learning with technology. Probably, the lack of inservice courses dealing with these issues combined with a school culture that makes little provision for professional development contributed to the situation in which Teacher Three found herself.

Another difficulty experienced by Teacher Three was lack of an appropriate space for teaching and learning about computers. The space she had available was not only cramped, leaving little room for group interaction, but located in a classroom annexe which meant that Teacher Three could not easily observe student activity in a split-group situation. In fact, there was only one place in the classroom from which both groups could be seen at once. Such circumstances are likely to lead to increased distraction for the teacher and impinge on class control.

Considering the above situation, it was interesting to consider how Teacher Three might incorporate the use of multimedia CD-ROM titles in her teaching approach. As she no longer had funding to get an IBM compatible with a CD-ROM player for her classroom, it was probable that the CD-ROM titles would be

used in the library. Possibly Teacher Three could attempt a whole class approach to introducing the title and explaining its use or groups of two or three students could be sent to the library during class to investigate assignment questions.

Overall reflections

The researcher's experiences with the participating teachers showed that there are many expectations placed on art teachers who have computer technology in their classrooms. Firstly, they are expected to manage the technical problems associated with their equipment. Secondly, they are expected to develop expertise in using a variety of software and hardware and thirdly, they are expected to develop classroom strategies for teaching students to use and understand a broad range of applications of technology in the visual arts. Furthermore, teachers are required to meet these expectations simultaneously and with little outside help.

This situation is confusing and frustrating for teachers who, as suggested by Van den Akker *et al.* (1992), need early

successful experiences. Ideally, teachers should be able to rely on some form of technical help with systems and management problems and they should be encouraged to develop competence in a range of computer applications before getting heavily involved in purchases of software and hardware. In this way, technology purchases can be guided by a clear vision of how computers can be applied to classroom needs. When technical support and teacher confidence are established, it is then easier to develop workable classroom strategies which are likely to result in success.

Teacher One's adjustment to the IBM compatible was one example where the expectations listed previously were met in a more logical order. Firstly, Teacher One already had the help of the school technician which meant she was relieved of technical problems and responsibilities and could feel confident that, should she get into trouble, someone supportive would be able to assist. As well, her early involvement with the school's technology committee ensured the likelihood of such support continuing into the future. Secondly, the purchase of the IBM compatible for the art staff room meant that Teacher One was able to concentrate on the development of her own skills before having to deal with

students' needs. She was able to achieve results, see practical outcomes and gain some understanding of the level of difficulty involved in learning about the software. Thirdly, Teacher One was able to draw on her personal experiences when considering the development of classroom teaching strategies and therefore was likely to have more realistic expectations of lesson outcomes.

Summary of Chapter Four

The case studies presented in this chapter revealed three very different educational settings. The teachers involved shared the struggle to integrate computers into visual arts education and had in common, problems caused by unreliable equipment, inappropriate inservice experiences, lack of resource materials and lack of technical support. The researcher's visits explored three different ways of meeting the needs of these teachers in their attempts to enrich visual arts education through the use of computers and understanding their points of view. Teacher One received one-to-one tuition from the researcher and benefited from the timely purchase of computer equipment for the art staff room. Teacher Two witnessed the attempts of the researcher to connect

computer use with the current unit of work and Teacher Three saw a range of students benefit from the exploration of interactive multimedia software.

The reward of action research is the deeper understanding of the situations in question and the recommendation of more appropriate actions based on the collaborative experiences of those involved. In the studies reported, future actions were recommended that included the purchase of non-computer resources such as posters and books, the implementation of projects which integrated the use of technology with the teachers specialist areas and extended computer use beyond graphic design and the creation of simple teacher made resources. These recommendations are presented in the appendices.

Chapter Five Analysis

Chapter Five Outline

This chapter is organised to answer the six questions, that contributed to an understanding of the research focus presented in Chapter One. These questions investigated teachers' perceptions, current class activities, curriculum integration, adaptation of teaching methods, factors which hindered or facilitated implementation and methods of assisting teachers. Significant issues are discussed within these six sections under subheadings that were derived from categories and relationships that emerged from the study and literature review. The chapter culminates in a summary which addresses the research focus "How may teaching and learning in high school visual arts classrooms be enriched by the application of available computer technology?".

Introduction

The analysis of the data collected during the research period involved the coding, categorisation and synthesis of a wide variety of items such as interview transcripts, diary entries, artefacts and reflections on discussions with staff and students. As well, the literature review provided a secondary source of data and helped sensitise the researcher to particular aspects of the field experience. The exploratory nature of the study meant that a wide variety of issues were uncovered, some of which are suitable for further investigation.

1. How do art teachers see computers enriching visual arts education?

The data related to teachers' perceptions of how computers may enrich visual arts education revealed that teachers believed that computers would provide considerable enrichment to the visual arts sometime in the future but that the reality of the present use of computer technology was generally disappointing and frustrating. In this way, the teachers who participated in the

study reflected the feelings of those in a variety of other studies and subject areas (Van Den Akker *et al.*, 1991). Teachers' positive perceptions of future applications were based in part on exposure to computer advertising, television features and discussions of future applications with friends and colleagues while their negative perceptions were based on the reality of previous and current experiences with computers in the classroom.

Van Den Akker *et al.* (1991) stressed the importance of successful early experiences for teachers using technology in the classroom. They defined such experiences as consisting of three main features. Firstly, that students attained clear learning results from using computers. Secondly, that the execution of the lesson should be problem free and thirdly, that the teacher should be aware of his or her contribution to the lesson. For the teachers in this study, neither their early experiences nor their current situation could be described as successful following this definition.

Teacher One had not experienced early success. The learning results for her students had been unclear. She commented

that the many technical problems with the Amiga had meant that even organising a 'free play' activity was problematic and Teacher One was generally unable to contribute to her students' progress. Teacher Two also commented that her experiences showed learning results for students to be vague or unrelated to the curriculum. As well, problems with faulty equipment and lack of system knowledge made lesson execution difficult. Teacher Two noted that her ability to contribute to student learning was minimal and relied upon novelty and gimmicks because of her inexperience. Teacher Three also had unsuccessful experiences. She commented that students' learning results had been disappointing and frequent equipment failures interrupted or prevented lessons. She also found that contributing to student progress was difficult due to the split-class teaching situation that made spending sufficient time with the computer group impractical. Teachers' perceptions of computers, therefore, were based on these negative classroom experiences. Typically, they considered the computer a poor substitute for traditional media, a difficult piece of equipment to use in class and one which offered few rewards for the expense of its upkeep. Such perceptions worked against the possibility of

future success with computer implementation by discouraging teachers from investing any additional time or effort.

The perceptions of the teachers in this study were further analysed using four categories suggested by Fullan (1982). These categories referred to the perceptions of those involved in the implementation of an innovation of the need for and relevance of that innovation; the clarity of the goals of those involved and their understanding of essential features; their awareness of the complexity of the innovation and their perceptions of its quality, practicality and impact. Fullan regarded weaknesses in any one category as likely to encourage failure.

A. Teachers' perceptions of the need for and relevance of computer technology.

Fullan suggests that successful implementation of an innovation depends, in part, upon whether those involved are aware of the need for the innovation and its relevance. In relation to this study, teachers felt that the main need for computer technology in the visual arts was to ensure that students would be able to take

advantage of future career and tertiary opportunities. Teachers' comments indicated an awareness that computers were increasingly used for design work in many art related occupations and that tertiary institutions expected students to have had some experience in their use. However, this awareness was of a general nature and did not include specifics such as exactly which occupations used computers or how they were used. Teacher Two extended the perception of career preparedness to include her own employment prospects. She believed that schools looked favourably upon staff who were confident and up to date with the latest technology.

Teachers' perceptions of the need for computers, at the present time, did not include the idea that computers were enriching to specific areas of the curriculum such as the practice of painting and drawing or the study of history. However, teachers seemed certain that computers would be enriching to these areas in the future. In fact, a sense of wonder was evident when teachers imagined the contribution computers might make to education and the arts at a later date.

Fullan goes on to question how those involved in implementation perceive the relative importance of the innovation. Teachers in this study held conflicting views regarding the relative importance of computers in the enrichment of visual arts education. On the one hand they felt pressured to prioritise the use of computers in order to justify their considerable expense when compared to other Art equipment. Teachers also felt pressured to prioritise learning about computers at the expense of professional development opportunities in other curriculum areas. On the other hand, teachers saw the computer as just another tool among the many that were already available in the art classroom and as such felt that it did not deserve preferential treatment. Contributing to this attitude were the disappointing results of past attempts to use the computer.

B. <u>The clarity of teachers' goals regarding the enrichment of visual arts education through the Use of technology</u>.

Having clear goals and clear understandings of the essential features of an innovation is considered by Fullan as

important to successful implementation. Apart from an awareness of the general directive to use technology from State and School bodies, teachers were left on their own to set goals regarding computer use. The clearest of the goals expressed by teachers focused on the practical concerns of acquiring or getting access to more and better hardware and software. Their goals were generally less specific in relation to uses of software and ways in which software could be integrated into the curriculum. See (1992) notes that this 'hardware first' approach is ineffective because it focuses on the technology instead of the learning outcomes desired by teachers. He suggests that less frustration and equipment redundancy occurs if a clear knowledge of the desired learning outcomes are the guiding force behind technology purchases.

While teachers believed that they had a clear understanding of the essential features of their computers, it was difficult for them to be specific about such things as how long it would take to learn to use a particular software program, the limitations of their software and hardware and how software capabilities related to Art activities. Through experience, however, teachers were aware of some of the practical

implications of using computers. This awareness included the understanding that in order to enrich visual arts education through the use of technology, a great deal of time and money was required. The technical understanding necessary to manage classroom computers was complex and the inconvenience of equipment malfunctions was frustrating and disruptive. Overall, the teachers in this study were not well prepared for the practical implications of having computers in their classrooms and stated that they did not have the time to learn about computers, had difficulty gaining the necessary funding for upgrades and repairs and did not have reliable maintenance strategies in place.

C. Teachers' perceptions of the complexity involved in using computers to enrich art education

In order for successful implementation to take place, Fullan suggests the importance of understanding how difficult it might be to learn about an innovation and how instructional practices might be affected by the complexities involved in its use. The literature revealed that the computer has the potential to affect all areas of the visual arts curriculum and therefore its use

could be considered a highly complex activity affecting a wide variety of instructional practices. Through early unsuccessful experiences, teachers were aware that using computers was very complicated. However, teachers' comments were based on attempts to use the computer in only a limited number of activities. Due to this factor, they were not fully aware of the complexity of realising the potential of computers across a broad range of art curriculum areas.

While teachers recognised that it was difficult to learn to use one piece of software, they were not fully aware that an art classroom in which the computer was integral to the curriculum could easily require the teacher to be confident in the use of several completely different software programs such as those used for desktop publishing, graphic design, image manipulation, animation, three dimensional modelling, video editing and multimedia authoring. Such a broad range of applications would necessitate the regular upgrading and broadening of skills and the development of appropriate teaching strategies in order to transfer these skills to students.

D. Teachers' perceptions of the quality, practicality and impact of using computers to enrich art education.

Perceptions about the quality and practicality of the innovation are the subject of Fullan's last category of factors which influence successful implementation. In general, teachers were not satisfied with the quality of the equipment with which they had to work. They had no examples of classroom use to follow and so the innovation came to them virtually untested. The teachers in this study generally felt that it was impractical to have only a few computers available for the use of groups of 28 or more students and that disappointing results did not justify the expense or the time involved in learning about software and hardware. They considered that they could not get support from either the schools' computer coordinators or the commercial sector because Amiga computers required skills and knowledge different from those currently held by these support people. All three teachers participating in this study were in the process of moving towards another brand of computer that would bring them into line with those used in their schools' computer laboratories. Teacher

One and Teacher Two were considering the IBMs and Teacher Three was considering Macintoshs.

Fullan also notes the importance of teachers' perceptions of the impact of computer technology. While teachers were unclear of exactly what impact computers would have on their subject area, they were certain that changes would occur. Personal concerns dominated as teachers related their fears that they would not be able to keep up with technical knowledge or meet financial demands. Their concerns revealed that they were at the early stages of concern as presented by Cicchaelli and Baecher (1989). Their interests revolved around their changing roles, the personal commitment necessary to be successful and the potential conflicts that might arise through the use of computers. Teacher Three showed some signs of moving from concerns about the self towards more task oriented concerns where management and organisational issues featured more highly. Lastly, Fullan regarded as important, teachers' perceptions of the trade-off between the actual benefits of the innovation and the personal and organisational costs of using the innovation. On this issue, teachers were clear. Due to their earlier negative experiences they believed that the trade-off

between benefits to visual arts education and the personal and organisational costs related to computers was very poor.

In summary, teachers' perceptions, while justifiable, created a considerable obstacle to their chances of successful enrichment of visual arts education through the use of computer technology. The teachers' belief that computers should ultimately result in savings in cost and time resulted in disappointment and revealed that computer inservice experiences, to date, had not shown that computer based art work could be appreciated as a form of expression in its own right or that computers could be used in an holistic way to enrich visual arts education. Teachers remained motivated to use computers mainly by outside pressures and not by any intrinsic appreciation of the advantages computers had to offer. Therefore, teachers in this study struggled with complex issues related to computer implementation and lacked the guidance of a clear vision or long term plan for implementation. They had no role models and few previous experiences of success to draw upon in creating a program which took advantage of the capacity of the computer to enrich classroom practice and generally remained

unconvinced of the benefits and practicality of computers when compared to personal and organisational costs.

2. What are art teachers currently doing with their available computer technology?

During the course of this study, teachers used computers both for the completion of professional tasks related to administration or lesson planning and for student learning activities. The activities noted before, during and after the action cycle of this study are recorded as follows.

Uses of computer technology before the commencemment of the action cycle.

Teachers	Activity
Teacher Three	Creation of worksheets by the teacher.
Teachers One, and Three	Unguided free exploration of paint Two programs by students.
Teacher Two and Three	Student exercise to create a company logo.
Teacher Three	Student exercise to design a Music CD cover.
Teacher Three	Digitising of images for use in assignments by students.

Teacher Two	Student colour and design exercise involving experimentation with colour schemes and pattern creation.
Teacher Three	Student exercise involving the exploration of the implied lines of an image and experimentation with colour palettes.

Additional uses of computer technology during the action cycle.

Teachers	**Activity**
Teacher One	Creation of posters advertising school functions by the teacher.
Teacher One	Creation of the cover for the School Magazine featuring a scanned image of a student drawing.
Teacher Two	Development of an artwork or series using a framegrabbed image as a starting point.
Teacher Three	Development of a multimedia presentation involving scanned images, text, animation and sound effects.

Uses of computer technology following the end of the action cycle.

Teachers	Activity
Teacher One and now Teacher Three	Continued use of the computer by the teacher for the development of worksheets.
Teacher One	Continued use of the computer by the teacher for the creation of school posters.
Teacher Three	Continued but infrequent use of the computer by students to digitise images for use in assignments.
Teacher Three	Student exercise involving the creation of a design for screen printing.
Teacher Two with the help of a visiting artist.	Student exercise involving the creation of images for projection onto a screen at the School Art exhibition.

The patterns of computer use across the three schools indicated that free play activities and graphic design activities such as logo and packaging design were favoured. Free play activities encouraged students to teach themselves and reinforced the idea held by teachers that students could learn to use the computer much faster than adults. The popularity of graphic design activities could perhaps be ascribed to the perception held by

teachers that computers were most frequently used in the graphic design industry. Also supporting this preference was the perception that the use of the computer for such tasks was time efficient and resulted in cleaner, more professional results whereas using the computer for other curriculum areas such as painting and drawing was perceived as difficult and did not result in a more professional outcome. Some experimentation with animation was evident at School Two and School Three but this was the result of spare time activities and was not taught as part of the curriculum. School Three was considering the purchase of three dimensional modelling software if a visiting artist with experience in that area could be secured to work at the school. However, in general, teachers were having difficulty making the best use of software they had already purchased.

While the listing of activities undertaken at each school revealed the range and pattern of usage, the researcher's dairy entries and observations were used to clarify the understandings which resulted from those activities. Categories referring to the use of stereotypical imagery, seriation, randomness, light, movement, audience participation and display formats were used to

identify and compare characteristics of the learning experiences in which the researcher was involved.

A. Stereotypical images

Stereotypical imagery, as noted by Freedman (1991) and Stokrocki (1986), resulted from use of the mouse as the sole input device and over reliance on software functions such as squares, circles and pattern fills. The researcher confirmed this observation of computer use at all three schools especially during free play activities. At Teacher One's school, where students used the computer as an unguided, spare time activity, images that had been created prior to the researcher's visits were stored on the computer's hard drive. These images consisted of the considerable use of the simpler functions of the software to create two dimensional images of houses, castles and people. At Teacher Two's school, images found stored on the computer hard drives were of a similar nature but also made use of software features such as pattern fills to create sunsets and faces. Students at Teacher Three's school were observed creating dragons and monsters using basic drawing tools during the researcher's visits.

Stereotypical images can be disappointing from a teacher's point of view because they can be perceived as representing a lack of maturity and forethought. However, students were usually quite pleased with their efforts.

B. Seriation

The use of seriation, as described in the literature (Freedman, 1991; Roland, 1990) was evident during the researcher's visits to School Two and School Three. At School Two, students experimented with their framegrabbed images, saving different versions along the way. Sometimes students had to be reminded to save as they did not like to interrupt their intense involvement with image editing. On occasions when students did not save they often found themselves disappointed with the final version as an earlier version was preferred but irretrievable. During intense periods of image manipulation, the computer was also most likely to crash, resulting in a loss of all work done since the last save. This reinforced the importance of creating a series of work. If more than one version of a particular artwork was printed out, students became easily engaged in

critique. While the work remained on the computer, critique through comparison was more difficult because both images could not be seen at the same time. During the researcher's visits to School Three, some use of seriation was evident in students' development of screen designs for the multimedia presentation. Two or three different layouts were saved before making a final decision on which colour scheme or composition was preferred.

C. Randomness

Use of the quality of randomness as referred to by Freedman (1991) was particularly evident during the researcher's visits to Teacher Two's classroom. The experimental nature of image development was suited to an appreciation of this characteristic. An acceptance of randomness and a willingness to take advantage of the unexpected was encouraged by the use of software features previously not known to the students such as transparency, spherising and distortion. The novelty of the software functions made it difficult for students to plan their work and instead they came to accept the element of surprise as part of the creative process.

D. Light

The quality of light discussed by Freedman was not a subject of discussion by students during the course of their work with the researcher. However, it was a noticeable characteristic, especially when print-outs where compared to the screen display of the same image. Significant colour differences between the screen image and the print-out were noticed and considered to be pleasing in some cases, while disappointing in others. In particular, screen artworks appeared distinct because they were created against a default black background while the printer interpreted that same background as white. Contrasts were diminished and incandescence lost. Textural differences were also notes as students commented that print-outs had the appearance of finely woven material. The varying characteristics between the quality of light emitted from a computer screen and the quality of light reflected from a paper print-out meant that, in many ways, the two represented completely separate artworks.

E. Movement and audience participation

Freedman identified movement and audience participation as two other qualities peculiar to working with computers. The researcher's experience at School Three showed that students were beginning to explore both these characteristics during work on the multimedia project. Students noted the effect of timing and screen transition on the image sequence and considered the point of view of the audience when making decisions. Students at School Two, who worked only with paint programs, did not consider these characteristics.

F. Display Formats

Apart from the multimedia presentation developed at School Three, display formats for computer based artworks were generally limited to print-outs and alternatives were not explored. Seeing a computer print-out represented an important step in the student work cycle and students were always eager to hold the results of their efforts. Psychological satisfaction was derived from being able to take the work away and present it in familiar

formats such as those used for other paper based artworks, for example, cardboard mounts, work portfolios or sketch books. However, due to the expense of paper and ink cartridges, students were not encouraged to experiment freely with printing but were generally expected to wait until they had decided on the final version of the artwork before committing it to paper. This prevented students from making valuable connections between the print and screen versions and from developing work further based on the critique of the paper product.

The multimedia presentation developed by students at School Three and its consequent demonstration at the school's annual art exhibition represented the first time the computer screen had been used as a display format. The computer was placed on an audio visual trolley at head height and set to loop through the presentation continuously. It stood amongst more traditional paintings, drawings and ceramics and attracted interest from passers-by.

In summary, current uses of computer technology across the three participating visual arts classrooms favoured graphic

design activities over other areas of the art curriculum. This situation could be attributed to teachers' association of computers with the graphic design industry, a lack of input devices and a lack of exposure to a wider range of classroom activities. However, attempts were made to extend the use of computers both during and after the researcher's visits and the exploration of a range of features important to computer based art was still possible. Unfortunately, such features as randomness, seriation and light were often not explored to their fullest or used constructively in the learning experiences of students due to a lack of awareness on the part of the teachers or a lack of available time.

3. To which art curriculum areas are computers applied?

By using the computer to prepare worksheets, Teachers One and Three had shown that the computer could be applied in this way to any area of the curriculum under study. Teacher Three had been using the computer for the development of worksheets for a number of years and Teacher One had begun to explore this option since the researcher's visits. Teacher Two did not have suitable

software for such tasks and so had been unable to experiment with this possibility. In a similar vein, students in Teacher Three's classes who occasionally digitised images for use in assignments were finding the computer useful for any area of the curriculum under study at that time.

Apart from these activities, however, computers were mostly used for studio practice rather than for activities of a specifically aesthetic, critical or historical focus. Within the area of studio practice, the literature indicated a wide range of activities to which computers could be applied such as painting, drawing, ceramics, printmaking, sculpture, multimedia and animation but at the beginning of this study teachers mainly used the computer for graphic design or colour and design activities. Graphic design activities focused on advertising or commercial design and did not cover as wide a range of graphic applications as suggested in the literature. Hubbard and Greh (1991), for example, indicated that graphic design applications in the visual arts curriculum could include architecture, textile design, industrial design and costume and stage design.

Perhaps one of the reasons for an initial preference for advertising and commercial design activities over fine art projects was suggested by Roland (1990) who noted that the mistaken perception of the computer as merely a simulated paint brush was often disappointing to teachers who could see no good reason to replace the real act of painting. Lack of examples of computer created fine artworks also contributed to the popularity of exercises of a graphic and commercial design nature. Those classrooms without input devices such as framegrabbers or scanners or with faulty devices were also more likely to restrict themselves to graphic design activities. The researcher's access to such devices during the course of the study meant that activities could be extended into other studio areas such as computer based art works, painting and drawing and multimedia presentations. It should be noted that the availability of CD-ROM titles such as the 'National Gallery of Art, London' (Microsoft, 1993), considered for purchase by Teacher Three, could mean that the computer might be used more frequently for history, critique or aesthetic activities in the near future.

The multimedia project attempted at School Three represented a mix of curriculum areas. The project combined studio areas with the examination of historical and cultural aspects of the chosen theme 'Animals in Art'. The project demanded some prerequisite knowledge of image editing, screen design and animation and as such represented a culminating activity for students with prior computer and art experience. However, if prescanned images were available, students could focus on the presentation aspects of multimedia packages without having previous experience with image-editing software.

In summary then, two of the participating teachers found the computer useful for the creation of worksheets. However, student activities generally involved studio practice in the curriculum area of graphic design and were most likely to be projects of an advertising or commercial design focus. Lack of resources and lack of awareness on the part of teachers contributed to this preference. However, during the researcher's visits to the school it was possible to expand applications of the computer to other studio areas such as painting and multimedia presentation. It was also likely that for Teacher Three, the

availability of CD-ROM titles would extend student computer activities into non-studio areas of the curriculum some time in the near future.

4. How have teachers adjusted to the presence of computer technology in their classrooms?

Art teachers have not had long to adjust to the presence of computers in the classroom. For many, the arrival of hardware at the school was their first contact with a computer. Few previous experiences prepared them to take on the difficult task of learning to use such specialised, complex and expensive equipment. This difficult challenge, however, was followed by another obstacle: how to integrate the technology into teaching practice and organise students to use the available computers? Teachers in this study were all considering the possibility of accessing a computer laboratory as sharing a few terminals around a whole class had not proven to be a worthwhile strategy. The laboratory versus classroom approach is discussed below along with current patterns of student use and the use of peer teaching.

A. The laboratory versus classroom approach

Visual arts teachers are well used to adopting split-group teaching strategies in order to make the most of limited equipment such as the pottery wheel, photographic equipment or printmaking tools. However, a split-group approach was generally considered unacceptable for teaching students to use computers. Teachers felt that students engaged in computer activities needed considerable attention if they were to move beyond free-play activities and achieve sound educational results. Managing the rest of the class meant that it was not usually possible for teachers to give the computer group this level of attention.

Consequently, negotiations to gain access to a computer laboratory, where students could have terminals to themselves, were underway at each of the participating schools. Laboratory use was considered to have advantages over the classroom situation because it allowed a whole class teaching approach and represented the most efficient way to impart basic computer skills. As well, accessing a laboratory meant that the computer coordinator employed by the school would take on the technical

responsibilities of managing the equipment, thus relieving the teacher of that difficult and time consuming task.

However, in general, teachers had only briefly considered some of the disadvantages of using a laboratory. These disadvantages included limited access to the laboratory due to conflicting timetable arrangements resulting in inadequate practice sessions for students, time wasted in shifting classes to and from the laboratory and the dissociation of the computer from other art activities. In particular, the separation of the computer from the art room might prevent the spontaneous use of the equipment as part of the cycle of work in other media, such as drawing or painting. A combination of laboratory and classroom access to computers might offer the ideal solution if computers in both locations ran similar software.

B. Patterns of student use

For teachers in this study, not being able to access a computer laboratory where each student had their own work terminal, tended to encourage haphazard patterns of computer use

in the classroom. Teachers One Two frequently adopted a 'whoever finished first' approach that resulted in the same students winning access to the computer each time while students who were slow to finish regularly missed out. On the contrary, Teacher Three noted that students who were slow to finish class work sometimes excelled on the computer because 'undo' functions meant that mistakes could be more easily fixed or interpreted as a positive experience.

Of all the participating teachers, Teacher Three's split-group approach resulted in the most consistent pattern of student use. All students in her classes were required to complete set projects using the computer. However, once the project was finished they were prevented from practicing their skills because they had to move onto other art assignments. Although all teachers expected that group interaction around the one computer terminal was an important and necessary part of computer use, none of the classrooms visited by the researcher were set up in a way that promoted group access to a single terminal. The computers were usually set up two to a desk which meant that crowding frequently occurred. Providing more space around each computer was

considered difficult due to the amount of other furniture and equipment already located in the art room.

C. Peer Teaching

Peer teaching was a popular strategy for showing students how to use computers at all the schools participating in this study. The strategy required little supervision from the teacher and reinforced the idea that students could learn about computers much faster than adults. During the researcher's visits, peer teaching was most successfully observed at School Three. The advanced skills of one of the members of the animation team meant that three of the other students with whom he worked were able to benefit from his expertise. However, several shortcomings with this approach were observed. Firstly, insufficient space around computer terminals had a detrimental effect on peer teaching as students could not see what was happening on the screen. This encouraged those not directly involved to talk amongst themselves on unrelated topics. Secondly, this advanced student was unable to improve his own skills during the project and felt hampered by the other team members. Thirdly, the other team members missed out

on some key learning experiences because the advanced student could not fully explain the methods involved in developing the animation sequence and fourthly, the other team members were unable to contribute greatly to the final production or practice what they had learned from the advanced student. Such difficulties are worthy of future investigation as Teachers One, Two and Three tended to rely on peer teaching as a strategy for managing computer lessons.

In summary, adapting to the use of computer technology presents a highly complex challenge for visual arts teachers. Hopes for success were pinned on the possibility of gaining access to a computer laboratory and on the perception that students would be able to learn quickly and teach their peers. Current classroom use of computers showed that student access to equipment was generally haphazard and revealed that while peer teaching was helpful it perhaps should not be relied on by teachers as the sole method of computer instruction.

5. Which features, elements or issues occurring in the teaching environment are seen as helping or hindering the use of computers in visual arts classrooms?

Factors that helped or hindered the use of computers in the visual arts classroom closely matched those discussed by Van Den Akker *et al.* (1992) and Zammit (1992). This similarity suggests that Art teachers face many of the same challenges as other members of the school staff in their attempts to implement computers in their subject area. Categories suggested by Van Den Akker *et al.* were used to help clarify and understand data that related to this question.

A. National and/or State Context

There was little evidence of the influence of National or State policies at the classroom level in teachers' comments. While a general awareness existed that technology use was encouraged within schools as it might relate to workplace training or employment opportunities for students, more specific

justifications which related to visual arts education content and method were missing.

B. School Characteristics

Van Den Akker *et al.* commented that a positive school environment where principals facilitated training, equipment purchases and timetable arrangements was vital to the successful classroom implementation of technology. However, the teachers in this study considered that the administration at each of their schools did not contribute to a positive school environment and hindered the use of technology either by failing to demonstrate a supportive role towards the visual arts or by failing to encourage the use of technology or both. Teacher One noted an obvious devaluing of the Arts at her school. Teacher Two commented on a lack of awareness among fellow staff about the achievements of the Art department and their use of technology and Teacher Three's difficulties revolved around a lack of support in technology purchases, maintenance and long term planning and a low opinion of the arts in general.

Van den Akker *et al.* also commented on the important role of the computer coordinator. For the teachers in this study, the computer coordinators' lack of expertise both in the area of visual arts applications and the Amiga platform presented an obstacle to computer use. Teacher Three's normal classroom concerns were complicated by the added responsibility of attempting to solve technical problems, organising and arranging for repairs and investigating equipment prices. Teacher Two noted that although the computer coordinator at her school had a very good reputation, he was not able to offer much help with Amiga problems. Teacher One made a similar comment, however, she was fortunate to have the help of a technician employed by the school. The technician was self motivated and frequently went out of his way to assist Teacher One with difficult problems concerning the Amiga computer. His assistance was considered indispensable in writing proposals, solving problems and setting up the new IBM compatible equipment in the art staff room. His presence encouraged Teacher One to be more confident and relieved some of the pressure placed on her to deal with technical and software problems.

C. External Support

Forms of external support taken advantage of by teachers in this study mainly consisted of inservice workshops, visiting artists or computer suppliers.

i) Inservice Workshops

Teachers usually found inservice workshops did not result in transfer of skills to the classroom. Many workshops they attended focused on the demonstration of a number of different types of software and did not allow enough time for skills practice. Other short term workshops concentrated on software features and offered little guidance in relation to curriculum integration. Reports of inservice experiences showed that few of the factors listed by Glass (1992) as promoting the transfer of learning to the classroom were present. For example, workshop conditions were not similar to teachers' classroom situations; extensive practice of tasks was not possible either at the workshop or upon return to school; a variety of concept examples was not available and general principles were not understood before more advanced concepts were presented. Teacher Three also complained that workshops she

had attended were not matched to her stage of development and spent too much time on basic features that she already understood. However, such inservice experiences, while lacking relevance to classroom practice, did serve the purpose of raising teachers' awareness of the types of software available and offered some opportunities for networking.

ii) Visiting Artists

A form of external support favoured by Teacher Two and under consideration by Teacher Three was the help of an 'Artist in Residence' with expertise in computers. 'Artist in Residence' programs in schools usually involve an artist working in a temporary studio somewhere on the school premises. Students are able to observe the artist at work and engage in conversation. The artist may also visit the classroom to give formal and informal talks. Teacher Two took advantage of this arrangement with a computer artist who had experience with Amiga computers. She later employed the artist to run after school workshops for a period of about one school term. After the researcher's visits to School Two, Teacher Two employed another computer artist with a performance background to continue the program. Teacher Three

had made a similar plan to gain the help of a young animator as an 'Artist in Residence'. His speciality was three dimensional animation and Teacher Three looked forward to the motivating effect his presence might have on students. However, this artist was unavailable at the time of the researcher's last contact with the school.

Some difficulties with the 'Artist in Residence' approach were noted. Firstly, Teacher Two noted that the artist's lack of teaching experience generally resulted in poor transfer of learning to students. Secondly, the researcher noted that interactions with the artist were not usually followed through into the classroom so a relationship was not drawn between the curriculum area under study and the visitor's area of expertise and thirdly, the researcher also noted that the teachers' computer skills were not improved by the presence of the artist.

iii) Computer Suppliers

Teacher Two and Teacher Three both expected computer suppliers to offer support and some training. Teacher Three had found her suppliers to be generally helpful around the time of

purchase of the machines but ongoing support had proved to be unreliable. At the time of the study, they were slow to respond to calls for information even when these requests may have led to sales. Teacher Two found that suppliers were unhelpful because she was not the original purchaser of the technology.

D. Innovation Characteristics

Van den Akker *et al.* discussed several characteristics of computer software that presented obstacles to classroom implementation. In particular, lack of software evaluation guides, poor documentation and lack of teacher guidelines were confirmed by this study as obstacles to successful implementation. The use of instructional videos by Teacher Three was one exception. Teacher Three found that the instructional videos which accompanied Deluxe Paint 4 were useful for a number of reasons. Firstly, students were able to watch the videos with little supervision from the teacher leaving her free to attend to other students. Secondly, the videos were shown on a television screen somewhat larger than the computer monitors, allowing all

members of the computer group an uninterrupted view and thirdly, the videos could be replayed or reviewed at any time.

One notable difference between the characteristics discussed by Van den Akker *et al.* and the situations observed by the researcher was that Van den Akker *et al.* frequently referred to problems involved in using stand-alone educational software, for example, drill and practice games for Mathematics. However, stand alone educational software was not available for the visual arts subject area. It is possible that software developers share the low opinion of the visual arts promoted by the school community and are unaware of the potential for computer use in this area or believe that the subject area is not suited to such software genres. Hopefully, the rapid growth in CD-ROM titles will help remedy this situation and if so, visual arts teachers may then find themselves faced by some of the problems listed by Van den Akker *et al.* such as lack of evaluation strategies, poor coverage of subject matter domains and software which is designed for individual use and does not promote group learning.

E. Hindering Factors

Factors hindering computer use identified by Zammit (1992) were also confirmed by the findings of this study. For example, gaining access to sufficient numbers of computers and having adequate time to review software were high on the list of obstacles noted by both the participants in Zammit's study and those of this study. In particular, lack of time was considered a serious and unavoidable obstacle by teachers participating in this research who perceived that a great deal of time was needed to learn to use software, practice skills, develop lessons and keep up to date. Poor quality software, lack of confidence and skill and the perception that computers were not a high priority were also reflected in both studies.

F. Facilitating Factors

Zammit suggests that access to computers, available software and self motivation to keep up to date were factors which encouraged teachers to use computers. These were also identified as facilitating factors in this study. Teacher One noted that access

to computers with suitable software greatly increased her personal use of computers. Teacher Three identified the available software and accompanying instructional videos available at her school as facilitating factors and all teachers regarded motivation to keep up to date as the main reason that encouraged them to participate in workshops.

Hadley and Sheingold (1993), however, reported motivational factors which differed from those listed by Zammit. Their study suggested that, for American participants, perceptions that students showed increased enthusiasm for their work, increased interest in learning and improved learning outcomes were the main factors which motivated teachers to use computers. Their results perhaps indicate a higher level of successful experiences with the classroom implementation of technology than the teachers referred to in Zammit's Australian study.

In summary, few characteristics of the participating schools encouraged technology use in the visual arts. Inservice workshops were generally considered unfruitful avenues of external support and characteristics of the innovation itself such

as lack of evaluation guidelines and lesson examples made teachers' attempts at implementation more difficult. Two facilitating factors identified in this study were the instructional videos provided with some paint software and the presence of a technician who was willing to deal with Amiga problems and offer general support to art staff.

6. In what ways would teachers most like to be helped in the use of computer technology in visual arts education?

Following the one-day AmigaVision workshop conducted at the beginning of the study, the research experience explored three ways in which teachers could be helped in their attempts to enrich visual arts education through the use of computers. The first case study involved the empowerment of the teacher through one-to-one tuition. The second case sought to empower both the teacher and students through a team teaching approach and the third case sought mainly to empower the students. During the course of the study, the main ways in which teachers could be helped became apparent. These included the creation of long term goals,

improvement in the relevance of inservice experiences, the provision on non-computer resources and the provision of technical support.

A. One-to-One tuition

The record of teacher's uses of the computer before, during and after the action cycle showed that Teacher One's practice changed the most since the time of the researcher's intervention. The researcher attributed this to three main factors. Firstly, Teacher One, being the least experienced of the three participants, had the most to gain from the researcher's expertise. Secondly, she benefited from the closest involvement with the researcher during the action cycle by taking part in one-to-one tuition sessions and thirdly, she was fortunate enough to receive a critical mass of computer equipment including software and a scanner which enabled her to complete the tasks in which she was most interested. Although one-to-one tuition is generally not thought to be a cost-effective method of professional development by higher education institutions, there are clearly some instances

where the long term benefits for teachers and students are worth considering.

B. Team teaching

Teacher Two's experience showed that little was gained from a team teaching approach for two main reasons. Firstly, during the researcher's visits the teacher was distracted by other classroom responsibilities and secondly, the researcher used an outside facility for framegrabbing images of student works which meant that repetition of the project by the teacher would be difficult unless she arranged to purchase her own input device or contact someone who could digitise some suitable images for class use. In this way, the researcher repeated the mistake of many inservice courses which do not mirror the conditions found in the participants' classrooms. However, further experimentation with a team teaching approach could result in more successful outcomes if alternative ways could be found for the classroom teacher to connect and extend activities presented during the expert's visits. This could require a higher level of personal commitment from the teacher.

C. Student empowerment

Teacher Three could also be expected to gain few long term benefits from the approach used at her school that sought to empower students. Although the participating students enjoyed working on the multimedia project, the fact that they were not able to practice using the software after the researcher's visits meant that retention of skills would most likely be poor. This would then interfere with the Teacher Three's plan to call on these students as peer teachers when next attempting such a project. Ways to improve and support peer teaching is worthy of further consideration if teachers are going to rely on this strategy as a method for computer education. The provision of posters which remind students of key operational sequences and the development of instructional videos which could be used by students with little or no supervision are two ways in which peer teachers could be helped to direct their fellow students in the absence of a teacher.

D. Creation of long term goals

Assisting teachers to create clear long term goals was perceived as necessary for the following reasons. Firstly, long term goals can help ensure a well rounded approach to computer implementation which encompasses a broad range of curriculum areas and does not focus solely on graphic design activities. Secondly, clear long term goals can assist in preparing budgets for the purchase of hardware, software, CD-ROM titles and other support materials based on desired outcomes and thirdly, long term goals can guide teachers in planning for inservice training and other ongoing staff development activities. However, while such an approach is considered worthwhile, at the present time, there is no guidance available for teachers who might wish to undertake this task of long term goal setting. Inservice workshops and teacher education currently focus on software features and pay little attention to the big picture of curriculum integration and the world of visual arts and technology.

E. Improved design of inservice workshops

Teachers' comments and findings from the literature review made it apparent that the design of inservice workshops could be improved upon in several ways. Firstly, workshops need to be designed to support teachers in the creation of long term goals and to help them to identify the steps required to reach those goals. Secondly, workshop content should be matched to teachers' needs. Thirdly, inservice activities should aim to offer solutions to curriculum integration across a broad range of Art curriculum areas by providing examples of successful lessons that are easily repeatable in the classroom settings of the participants.

F. Provision of non-computer resources

The provision of non-computer resources to support classroom activities offers another and important way to assist teachers in the enrichment of visual arts education through the use of computers. Teacher Three's use of instructional videos highlights one example of the benefits of such resources. By creating videos which also explored computer artists and their

work and presented current issues related to art and technology, a comprehensive library for independent small group or whole class instruction could be made available. Similarly, posters, books and curriculum guides are also useful formats for supporting resources. In the near future, it might be beneficial to consider ways in which the Internet and electronic networking could help visual arts teachers to share problems and ideas.

G. Provision of technical support

All the teachers involved in the study required the help of a computer technician to relieve them of the difficult task of managing systems, organising repairs and purchases. With the rapid growth of imaging and graphic software it is timely that workshops for Computer Coordinators should include content related to the needs of visual arts staff.

Summary: How may teaching and learning in the visual arts be enriched by the use of available computer technology?

The analysis and comparison of interviews, field notes and literature revealed a list of widely varying applications and approaches to computer use suitable for enriching teaching and learning in the visual arts and gave an indication of the scope and flexibility of the computer as an important part of the Art curriculum. Examples can be found of computers being used to support and extend work in traditional media, to create computer based artworks, to encourage critique and aesthetic understandings and to assist teachers in daily managerial tasks.

However, many obstacles were shown to be standing in the way of visual art teachers who wished to make the most of their classroom technology. Teachers did not have access to support materials or professional development that encouraged them to take a long term view of computer implementation or appreciate the broad range of applications suitable for the visual arts curriculum. Lack of time for professional development, faulty

equipment, lack of technical support, inappropriate software and lack of strategies for curriculum integration compounded this situation and created further difficulties.

Obstacles specifically related to the uniqueness of the visual arts classroom were also uncovered. In particular, the varied range of practical and theoretical activities included in the visual arts curriculum placed special constraints on teacher preparation time, budgets, professional development, class management and spatial organisation. Platform differences between computers used in the Art department and computers used in other departments within the school also created difficulties in gaining technical support and recognition. Lack of training and curriculum materials specific to the visual arts subject area, lack of role models using technology successfully and lack of awareness as to possible and personally achievable applications all impeded the progress of teachers coming to terms with computer technology.

Alternatively, some key elements were present which helped facilitate the use of computers. These included the availability of an often unofficial technical consultant or helper in the form of a visiting artist; the use of the computer by teachers for their personal or professional projects and the availability of input devices such as scanners or frame grabbers. The presence of students with previous experience in computer related art activities who could act as peer tutors was also seen as important. Implementation was eased by well equipped settings in which technical support was available and reliable and where clear links to curriculum goals were evident.

Finally, it became evident that in order to help teachers succeed in the task of enriching visual arts education through the use of computers, a number of strategies was possible. These included:

1. the identification of long term goals to help teachers plan on-going professional development, curriculum design and equipment purchases;

2. the improved design of inservice workshops in which an on-going program of experiences took into account the developmental needs and individual goals of teachers within a long term view;
3. opportunities for one-to-one tuition where the individual circumstances pertaining to that school and that teacher could be taken into account;
4. preparation of non-computer resources which supported the study of both practical and theoretical issues related to technology and art such as 'How To' charts and examples of computer based art works;
5. more thorough preparation of selected students to act as peer teachers. Such preparation could include the provision of easy to follow charts and guides, the provision of out-of-class access to equipment, a system of acknowledgment for help offered and a method of reporting progress back to the teacher and
6. ensuring that technical assistance relevant to the needs of visual arts activities is available.

Chapter Six Discussion and Conclusion

Chapter Six Outline

This chapter notes the gap between the potential of computer technology to enrich visual arts education and the reality experienced by teachers who participated in this study. In an attempt to help bridge this gap, models derived from the researcher's work with the participants and the review of the literature are presented and discussed. The need for resources to be developed that support those models and for school administrations to take a more knowledgeable and encouraging stance towards the arts is then noted, while questions suitable for further exploration are presented before the Chapter Summary.

Introduction

In Chapter One, the researcher stated her belief that people construct their own view of reality based on a shared social

context. This study attempted to identify some of the elements that made up the social context of the participating teachers in order to understand their experience of the classroom use of computers. Teachers' perceptions about computer use contained both extremes of a continuum of possible approaches to computer implementation in the visual arts. At one end of the continuum, teachers believed that anything was possible and that computer technology could lead to sophisticated educational experiences for their subject area. At the other end of the continuum, the reality of classroom practice revealed that problems and shortcomings in resources and planning generally outweighed the benefits of computer technology. Missing from teachers' perceptions were all the incremental steps which made up the continuum and separated these two extremes.

Potential Versus Reality: Noting the Gap

Idealistic views about technology are frequently presented in the media. Television programs such as 'Beyond 2000' (Channel 10), 'The Big Byte' (SBS) and 'Hot Chips' (ABC) demonstrate many exciting applications featuring the latest technology. Advertisers

promote computers by presenting impressive end products in a manner which makes glossy results appear easy to achieve by a novice with only the minimum of equipment. The literature reviewed also painted a promising picture of the application of computers to the visual arts without detailing the prerequisite knowledge and experiences needed to achieve the results described. Detailed and repeatable examples of visual arts teachers successfully implementing computers in average classroom settings are not readily available. Under such circumstances, it is easy for teachers such as those represented by this study to believe that anything is possible sometime in the future without understanding the contribution that needs to be made by them in the present.

In the average classroom setting, holding idealistic views about computers, without an appreciation of the incremental steps needed for their achievement, resulted in feelings of anxiety, inadequacy and frustration. The promise of benefits for teachers and students were generally not fulfilled. Teachers felt pressured to provide students with computer experiences that would lead to employment or further education opportunities. They felt

pressured to be seen to be using technology by their schools for the benefit of parents and for the sake of their own career prospects. Unfortunately, it was these pressures more than the idea that technology could be seen to be helping students learn about the visual arts which motivated teachers to continue in their attempts to use computers in the classroom.

However, the importance of having an ideal vision of how computers can be used to enrich visual arts education should not be undermined. Idealism is vital for raising energy and inspiring those involved to overcome obstacles and setbacks. Yet, in order for a vision to move beyond inspiration and become a guide for one's activities in a more concrete way, that vision needs to be broken down into the many smaller, more achievable steps that will eventually lead to its realisation. Periodically thereafter, one's efforts towards such a direction need to be evaluated. Therefore, this study suggests the theory that in order to bridge the gap between the reality of computer use and its potential, it is the responsibility of teacher educators and supporters of visual arts education to have three fundamental objectives:

1. to help teachers clarify their vision of the ways in which computer technology can be used to enrich visual arts education;
2. to provide teachers with clear directions regarding the incremental steps involved in the fulfilment of a vision of the potential use of computer technology in the visual arts; and
3. to provide a way for visual arts teachers to evaluate the use of computer technology in their classrooms.

1. Clarifying the vision of technology use in visual arts education.

From the findings of this study and the work of Art educators such as Hubbard and Greh (1991), Freedman (1991) and Roland (1990), it has been shown that, ideally, computer use in the visual arts should encompass a wide range of art curriculum areas and consequently use a variety of software, hardware and input devices. Whilst any list or model of possible applications is incomplete due to the rate of technological change, it is nevertheless important to bring together, on a regular basis, such a

model of possibilities in order to anchor concepts related to computer use in the visual arts classroom. **Diagram 5** is an attempt at such a model and is put forward as a way for teachers to consider some basic categories of activities for the visual arts that take advantage of current computer technology. The model can also be used to help teachers identify the categories under which their current classroom activities fall and to stimulate thought as to which categories remain yet to be explored.

The scope and variety of the activities presented in **Diagram 5** is perhaps most important to note when helping teachers to develop a vision of how computers may be used to enrich visual arts teaching and learning. Such a broadened view may assist teachers in the conceptualisation of interesting programs that highlight well integrated and creative uses of computer technology. Teachers need to be encouraged to discard the limited view that the main reason for using computers is to save money or save time as this misperception ignores the potential of the medium to be used as an art form in its own right. Likewise, teachers should be made aware that the computer is not used best when its use is treated as a separate subject.

Model of Activity Categories for the Use of Computers in Visual Arts Education

Diagram 5

Extension of Traditional Media
(through the use of the computer as a visualisation or diagnostic tool)

Creation of Computer Based Art Works

Development of Critical Understandings of Unique Characteristics of Digital Artworks and Designs

Exploration of Presentation Formats (such as printouts, screen output or installations)

Development of Interactive Artworks

Layout and Lettering Production for Advertising or Commercial Design

Textiles and Fibre and Costume Design

Architectural, Interior and Stage Design

Three Dimensional Sculpture and Industrial Design

Presentation of Student Assignments using Desktop Publishing/ Word Processing

Presentation of Student Assignments using Digital Slides or Interactive Multimedia

Industrial and Product design

Exploration of Digital Photography and Image Editing

Production of Animations and Titling

Development of Classroom Resources
(using Desktop Publishing, Word Processing Software, Slide Show or Multimedia Authoring software)

Use of Electronic Resources such as CD-ROMs, On-line Databases and Internet sites
(for the study of history, aesthetics, criticism or studio techniques)

Development of Critical Understandings of Wider Issues related to Technology Use
(such as copyright, cultural homogenisation, inequality of access and computer crime)

Use of Computers for Management and Administration Tasks
(such as Student Records, Exams, Inventories or Resource Databases)

Implementation of Interdisciplinary Collaborative Projects

Networking with other Schools, Teachers and Art Institutions to exchange artworks and knowledge

Familiarisation with a Variety of Computer Platforms, Operating Systems and Input Devices

When computers are seen as a separate unit in the arts curriculum, some of their versatility is lost. Students are prevented from thinking creatively about ways to integrate the whole computer into the artistic process and instead confine themselves to the limits of one software program. This restricts them to the creative vision and bias of the software developers.

Helping teachers to become aware of the full palette of computer activities relevant to the Arts curriculum may be a little overwhelming at first and is not sufficient in itself to result in better lesson planning, teaching and learning experiences or equipment purchase. There are teachers for whom some of the suggested activity categories may be completely foreign while other teachers may harbour unrealistic expectations of the technology or themselves about the ease with which quality learning outcomes may be achieved. More specific information is necessary. Details about the difficulty of each activity category are needed, particularly as these may suggest a sequence of learning experiences which progress from beginner to advanced levels.

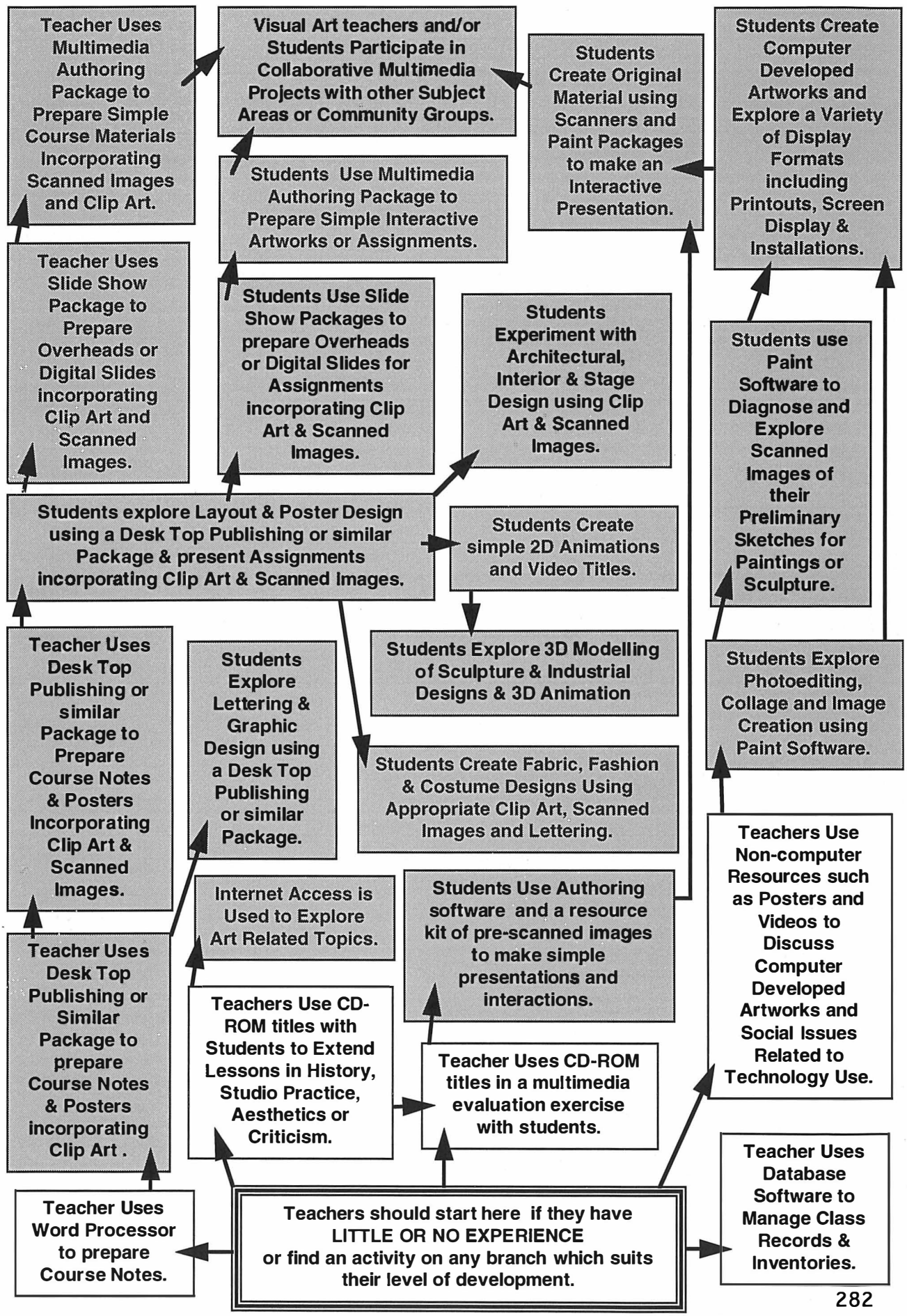
2. Incremental steps involved in fulfilling the vision of technology use in visual arts education.

As already suggested, once a broad vision for the use of computer technology in visual arts education has been established, it is essential that teachers be provided with detailed information which suggests the incremental steps they might take towards the realisation of that vision. Based on the researcher's experience, **Diagram 6** presents one model of a sequence of steps, linking the broad range of activities made possible by the combination of Art education and computer technology. Such a model may be used in two ways.

a) Teachers may locate themselves on the model in terms of the types of activities in which they currently engage with their students. Then, when ready to expand their activities, those teachers and students can follow the model, in the direction of the arrows, to discover activities which would most easily extend their current skills and understandings.

Diagram 6

Conceptual Model Showing Range and Sequence of Activities for the Implementation of Computers in the Visual Arts.



b) Teachers and students may choose activities from the model and then trace the arrows backward through the model to reveal a sequence of activities which would most easily lead them to their chosen aim.

The use of the model shown in **Diagram 6** in either of the two ways described benefits teachers and students by enabling them to recognise their own stage of development and locate matching activities likely to result in successful experiences. The model may also be a useful guide to the direction of future growth may take by encouraging realistic expectations based on skill levels, interests, available equipment and available professional development. Such small, achievable goals set within a larger context enables teachers to target their lessons and purchasing plans so that satisfactory educational outcomes will result.

Whilst the model illustrates how a teacher may make a logical progression from their current location on a developmental continuum, towards teaching situations of greater complexity, it should be noted that the pathways shown are based on the

researcher's experience and aim to be not prescriptive but to be adaptable to the needs and ideas of the teachers using the model.

The following example shows a sequence of activities, related to multimedia, that demonstrates the use of the model beginning with an activity suitable for teachers with little previous computer experience and ending with a collaborative, interdisciplinary project which requires a large investment in hardware and software, presents some organisational difficulties and demands that students and teachers be familiar with several pieces of software and hardware. Note that a characteristic of the model is that there may be more than one path to a particular activity. Therefore, an alternative approach to preparing for a multimedia project, beginning with the desktop publishing branch, is also suggested.

Multimedia Example: Activity One

A teacher with no previous experience might find using professionally developed CD-ROM titles the easiest and most cost effective way to begin exploring multimedia with students. An early successful activity would be to engage students in a critical

discussion and evaluation of the characteristic qualities of a multimedia CD-ROM. In order to do this, the teacher would need to be aware of such characteristics as screen layout, transition effects, sequencing, special effects, types of interactions, navigation devices and response times. Such a critique of the production values of a professionally prepared CD-ROM title is a valuable exercise for students who will be future consumers and who may be interested in multimedia creation. While the educational content of the CD-ROM title being examined is not the focus of the activity, selecting an art and design title could provide additional benefits. Many schools will already have CD-ROM players available somewhere in the school and therefore the purchase of a few titles for the Art department would be a sensible, low cost, long term investment.

Multimedia Activity Two

The next step on the multimedia branch of the conceptual map requires the school to purchase multimedia authoring software. Starting with a simple program such as Hyperbook for the Amiga is recommended. These simpler programs sometimes do not support such features as sound or video but they do allow the

exploration of screen design, sequencing, transitions and interactions. Through attending a workshop or using the manual, the teacher involved could expect to gain familiarity with a simple authoring program in about 5 x 2 hour sessions. Resource kits designed around a theme which contain a range of prescanned images, screen designs and if required, sound effects or video clips, could then be used with the authoring software, thus reducing preparation time and eliminating the need for students and teachers to have prerequisite skills in scanning, image editing and video capture. The use of such a resource kit would enable teachers and students to focus on multimedia issues without over complicating the lesson.

Multimedia Activity Three

Creating a multimedia activity using original material is a much more complex activity and represents a third step along the multimedia branch of the conceptual map. Students and teachers need to be confident in the use of several other software packages and peripherals as well as the authoring software itself. Those involved in the project will need to decide on content, source materials, digitise images, edit images and create screen designs,

sequences and navigation systems. They may need to write audio scripts, record and edit sound and video as well as deal with the characteristic features of multimedia such as interaction design and screen transition. Students who have participated in the two previous activities on the branch would have a much better chance of success in this exercise. The critical review of a multimedia program and the experience of putting together a simplified version of a multimedia package using ready-made screens would prepare students to conceptualise a more advanced project.

Multimedia Activity Four

The creation of student made multimedia programs presents a great opportunity for collaborative partnerships between the Art department and other departments within the school and represents one more step along the multimedia branch. For example, a collaborative project about botany could involve the Art department in screen design, image development and authoring; the Music department in preparing sound effects and music; the Drama department in supplying scripts, actors and video and the Science department in providing content. Being successful in completing a collaborative multimedia project requires a certain

level of professionalism on the part of the students and therefore this activity is suggested as an end point to the multimedia branch. Hopefully, such interdisciplinary adventures may help to break down myths about the value of Art education and promote better understanding between staff and students who have had little or no contact with the visual arts.

Approaching Multimedia from an Alternative Starting Point

As multimedia presentations are the culmination of many different types of software and media, there are alternative paths leading to a student multimedia project that may be preferred by some teachers. For instance, a class that has had some experience with layout and lettering using a graphics program or desktop publishing package and who is familiar with scanning and image editing might easily progress, as an intermediary step, to a slide presentation program which shares many similar functions and icons.

By using a slide program, students will learn about the differences between page and screen design, the use of transition

effects and the impact of timing and sequencing. Progressing from a slide presentation to multimedia authoring is then made less daunting. The major focus of the multimedia lessons, therefore, will be able to revolve around unique multimedia characteristics such as branching, navigation, interactivity and the incorporation of sound, video and animation.

Of course, once teachers have established a broad vision of the way computers can be used to enrich visual arts education and have located themselves on a continuum of activities, there are still many other factors impinging on the success of their classroom experiences and their ability to advance along that continuum. Art teachers need a way to assess their use of technology in a manner which not only looks at the range of activities offered to students but considers other important factors such as the availability of technical assistance and the opportunity for teachers to communicate with other peers using technology in the arts.

3. Providing an evaluation model for teachers using technology in the visual arts.

During the early stages of the research cycle, the researcher found herself alarmed at the number of difficulties facing participating teachers in their attempts to use computer technology in their classrooms. In order to get a clearer picture of these problems, a chart was developed which categorised and described these difficulties and projected their resolution (**Diagram 4**, p.135). These categories, emerging as they did from discussions with teachers and observations in the classroom, not only included concerns about the range of activities that teachers were offering to students but more practical issues such as whether or not technical assistance was available; whether communication with peers using technology in visual arts was possible and whether students had sufficient access to computers to allow them to practice the skills they were learning.

A chart, such as that shown in **Diagram 4** or one adapted to the personal needs of the teachers involved, could provide a model by which teachers may periodically evaluate the use of

technology in their classrooms in an holistic way. The chart can help to identify weak points in the teacher's approach to technology use which might be interfering with the success and enjoyment of computers as an integral part of the visual arts. Teachers made more aware of their own needs by the use of such an evaluation instrument may find it easier to communicate with administration and peers and so share ideas and strengthen classroom experiences through an exchange of knowledge.

Answering the need for supporting resources & professional development.

The success of the three models discussed previously, relies in part on the development of appropriate supporting resources and professional development experiences. During the researcher's experience with the study participants, various resources that could aid teachers in the classroom were identified. These resources, usually noted for their lack of availability, could be categorised under three main headings: lesson guidelines, software related resources and non-computer resources.

a) Lesson guidelines

Teachers with computer experience may need only brief guide lines, offering new ideas for lessons by teachers with little experience could benefit from more detailed lesson guidelines which specify such things as:

* the aims and objectives of the lesson;
* how the lesson may be integrated with the art curriculum and what follow on activities might be suitable;
* the prerequisite computer skills needed by teachers and students;
* the computer skills the teacher will need to complete the lesson;
* the level of difficulty of the lesson;
* the recommended group size;
* preparation time and lesson time;
* hardware and software requirements;
* any supporting resources required for the lesson and
* any values and critical understandings the lesson is able to highlight.

b) Software related resources

Software related resources are those supporting resources which directly relate to computer software packages. Examples of these are the DeluxePaint 4 instructional videos which were found very useful by Teacher 3. Other examples might include:

* instructional videos for other software packages;
* clip art and prescanned images on disk or CD;
* ready made images, sound and video designed around a theme for use with multimedia authoring software and
* wall charts reminding students of software functions and procedures.

c) Non-computer resources

Non-computer resources are those resources that can be used to teach students about computer technology without necessarily needing a computer. Such resources are very important for teachers who have little computer experience or have limited access to computers. Examples of such resources include:

* posters, prints and books featuring computer based artists and their artworks;
* articles and books which discuss the wider issues of technology use in language appropriate to high school students and
* descriptions of careers which incorporate Visual Arts skills and computer technology in the form of media interviews and profiles.

Of course, apart from supporting resources, the other type of support required by teachers is professional development. Whether occurring at the pre-service or inservice levels, professional development, should aim to offer repeatable classroom experiences that are aimed at the developmental stage of the participants. As suggested by the literature, professional development not planned in this way may raise the awareness of participants but not necessarily result in any improvement in classroom practice. Professional development providers and teachers may need to share a frame of reference, such as that offered by the models in Diagrams 4, 5 and 6, for thinking about the computer activities in the visual arts. Perhaps then, teachers

would be more likely to choose workshops and inservice experiences that related to their needs and their particular classroom situation.

Answering the need for a supportive environment.

Helping teachers to see the larger picture of computer use in the visual arts and the steps they can take to improve their classroom activities has to take place in a supportive environment which acknowledges the importance of visual arts education to contemporary society. Visual arts teachers require the respect and encouragement of school administrators and parents in order to be successful in their attempts to use computer technology. The unique contribution of the visual arts has to be recognised and concessions made for the time and technical support necessary to update teachers' skills and maintain computer equipment. Time, in particular is an important issue as many teachers currently in service need extensive tuition and skills practice in order to present effective Art and technology education to their students. Unfortunately, if no government initiatives are forthcoming in helping to re-educate staff about the contribution of the Arts to

the school, then Arts teachers themselves, need to be ingenious in the promotion of their subject area in order to win the support of the school and gain funding for training time and tuition. It is possible that the technology itself can be used to help them achieve this end, increase the status of the visual arts and staff awareness within the school and promote student involvement and collaboration between subject areas. Strategies for increasing the status of the visual arts through the use of technology might include:

a) producing a school newsletter;

b) creating an annual arts magazine;

c) designing posters for other departments;

d) preparing a technology and art display for the computer laboratory and library;

e) using the Internet to share ideas and expertise with visual arts departments in other schools;

f) collaborating with other departments in the production of slide presentations and multimedia projects and

g) collaborating with members of the community in a variety of projects which require the use of visual arts and computer skills.

Questions suitable for further exploration.

The combination of visual arts, technology and education is an area ripe with opportunities for research. This study has explored several questions related to classroom experience and has helped to identify further questions. In particular, the following areas are suggested as being worthy of further investigation:

a) more complete investigations into the quality and quantity of computer inservices being offered to art teachers, nation wide, and their value to classroom practice;

b) explorations of methods suitable for broadening teachers' perceptions about the applications of computers to the visual arts curriculum;

c) comparisons of the characteristics of schools with exemplary art and technology programs with schools that offer programs considered to be of a poorer quality.

d) analyses of how CD-ROM resources are being used in the visual arts classroom;

e) investigations of what makes a good CD-ROM resource for visual arts education resulting in an

evaluation guideline;

f) explorations into how Internet access to art galleries, exhibitions and interest groups may enrich visual arts education;

g) investigations into how teachers can support and improve peer teaching amongst students in technology based areas of the visual arts;

h) explorations into how the status of visual arts education can be lifted through the use of computer technology;

i) investigations into how careers advisers view the connection between visual arts, technology and students' employment prospects and

h) investigations into whether or not the use of image editing software improves students' ability to think visually and create solutions and alternatives to visual problems.

Summary of Chapter Six

In summary, this study suggests that computer technology can enrich visual arts education in a wide variety of ways and advises that computer technology should be considered an important part of the visual arts curriculum, given the current climate of expansion in visual information technologies. However, the study also recognises that in order for teachers to deal with the many difficult issues surrounding the successful use of computer technology in the visual arts, five key understandings should be taken into account by pre-service and inservice providers, school administrators and the teachers themselves. These key understandings are summarised as follows.

1. An understanding or awareness of the variety of ways computers can be used to enrich teaching and learning in the visual arts and how they integrate with the visual arts curriculum.
2. An understanding that a realistic sequence of activities, based on levels of difficulty, should be offered to teachers in order to help them bridge the gap between the imagined potential of computer

technology and the sometimes disappointing reality of classroom practice.

3. An understanding that periodic evaluation of the technology education offered by visual arts departments is necessary in order to identify areas of need and plan for those needs to be met. The evaluation must not only look at the range of activities being offered but the presence or absence of other contributing factors such as administrative or technical support.

4. An understanding that a range of supporting resources including lesson guide lines, software related resources and non-computer resources needs to be developed and made available along with appropriate and on-going professional development.

5. An understanding that visual arts teachers should receive the full co-operation of their school administrators in improving computer use in the visual arts and in return, teachers should take every opportunity to demonstrate the relevance of Visual arts education to their school community.

While the researcher has found the exploration of this study's research focus and the identification of these five key concepts personally enriching, an action research project does not usually end with a chapter summary. Typically, the findings from one cycle of action and reflection will contribute directly to the lives of the study participants and inspire further investigation to either test the value of those findings or to gather information related to new issues which may have emerged.

In relation to the participants of this study, the findings summarised in **Diagrams 4, 5** and **6** should be put to the test. Firstly, a model such as the one suggested in **Diagram 4** should be used to evaluate the current success of the teachers' art and technology programs, identifying their needs in the context of a school environment in which many factors, other than just the teachers' expertise, may influence the success of computer use. Secondly, a model such as the one suggested by **Diagram 5** should be used to identify the teachers' areas of interest and thirdly, the model suggested by **Diagram 6** should be used to map out a realistic plan which shows how teachers may best move from their current situation to a future situation in which pressing needs are

being met and technology is being used in an interesting and creative way within the visual arts classroom. In the spirit of action research, such a plan has been put forward for each of the participating teachers and can be found in **Appendices 1, 2** and **3**.

Concluding comments

In conclusion, this study has shown that computer technology can enrich teaching and learning in the visual arts classroom in a surprising variety of ways from extending work in many types of traditional media to the development of new forms of computer based artworks and new ways of displaying and thinking about art. This range of possible uses means that applying technology to the visual arts classroom is a highly creative and complex process requiring imagination and skill to visualise, believe and enact. While creative approaches to teaching and learning are frequently associated with the visual arts, the teachers who participated in this study were experiencing difficulty in taking advantage of all that their available technology had to offer. Of the variety of factors that contributed to this

situation, by far the most significant problem was lack of appropriate teacher training and inservice opportunities.

The description of the study context presented in Chapter One showed that the speed with which technology has advanced and become a commonplace part of youth culture outside the school environment emphasises the need for teachers to be aware of the contribution they can make. Through school-based education, they have the opportunity to prepare students to be critically aware creators and consumers of technology. Visual arts teachers share a significant part of this responsibility with other educators but, unfortunately, the current approach to teacher education of offering a few inservice workshops on how to use the features of a particular program will not equip teachers with the understandings necessary to explore wider issues or instil a sense of empowerment and co-creation in their students.

Both teacher education and inservice workshops need to pay a great deal more attention to enlightening teachers to the full potential for enrichment to the visual arts offered by technology. They should encourage discussion among teachers of the impact of

technology on the visual arts and society and aim to develop an awareness of the characteristic qualities of computer based art work as well as offer instruction in the practical issues of how to use and manage technology in the classroom. Such understandings should not be an elective for the already enthusiastic but should form part of the core understandings of all visual arts teachers.

Such a thorough and ongoing approach to training for the enrichment of visual arts education through the use of technology can only take place in a school environment where administrators and policy makers have reconsidered the value of visual arts education to the lives of students and are prepared to offer appropriate resources and support to visual arts programs.

Appendix 1

Recommendations for Teacher One

Future actions

At the conclusion of the cycle of action and reflection recorded in this study, the evaluation model shown in **Diagram 4** helped to identify that Teacher One might be ready to consider sharing her new found skills with students, if support could be gained from technical staff and administration to gain access to the computer laboratory. If support were to be found, it would also be appropriate for Teacher One to look at improving patterns of student access to computers both within and outside class hours. Another option for advancement was the broadening of Teacher One's own skills beyond the graphics area of layout and lettering. Investing in a range of non-computer resources such as posters and books was also recommended as an easy way to begin teaching about the wider issues related to art and technology. Therefore the following plan was suggested.

1. Sharing skills with students.

a) Gain access to the computer laboratory.

Teacher One needs to arrange block access to the computer laboratory for a suggested period of not less than three weeks.

b) Develop a teaching strategy.

Teacher One would need to develop a teaching strategy for working in a laboratory setting. Points to consider include the need for students to refer to their preliminary sketches in the laboratory. A project guideline outlining the steps involved in using the basic features of the program and discussing the characteristics of computer based art may be useful. The teacher may need to show students how to use on-line help or she may need to be prepared to refer to the manual herself while teaching. A classroom debriefing session and shared evaluation might be useful at the end of this exercise.

c) Arrange display space within the laboratory.

Arranging for the display of technology related art works or information in the laboratory setting would

serve two purposes. Firstly, it would act as a stimulus for Art students and secondly, it would raise awareness of the connection between art and technology for non-Art staff and students who use the facility, thus helping to raise the status of the Visual Arts within the school.

d) Arrange lunchtime access for interested students.

Arranging lunch time access for students would be to Teacher One's advantage because through encouraging students to practice their skills they may be able to help less confident students and the teacher in the following sessions.

e) Continue to encourage lunchtime access.

It is important for interested students to maintain their skills after block access to the laboratory has expired. The research experience showed that computer skills are soon forgotten unless regularly practiced.

2. Expanding skills.

a) Choose an enrichment project based on Teacher One's personal interests.

A project linking computer use to Teacher One's specialist area could be designed to explore the more advanced image editing features of her available software. For example, scanned images of pottery and ceramic ware could be the basis for computer manipulation in which a variety of structures, textures and decorative features could be tried.

b) Learn about the features of CorelPhotoPaint

A project such as that described above would require Teacher One to learn about new and complex software features. This step could prove difficult for Teacher One as finding a workshop suited to her current level of development which covered the necessary topics might be impossible. Teacher One might have to learn by herself through experimentation and referring to the manual or arrange for private tuition. It would be useful if examples of such an exercise were available for reference.

c) Transfer the project to the classroom.

On the assumption that the initial results were worthwhile, the activity could then be transferred to the laboratory. If a scanner were not available for student use, Teacher One would need to pre-scan photographs of pottery for the lesson. Student print-outs could later be used as a stimulus for clay work and decoration back in the art room. Teacher One could investigate whether or not such an activity facilitated imaginative approaches among students and resulted in more sophisticated and adventurous results.

3. Purchase of non-computer resources.

The third possibility for improvement in Teacher One's situation involves setting aside a small amount of the Art budget to purchase some non-computer resources such as books, posters and magazines which could be used to raise awareness and broaden perceptions about issues related to the use of technology in art.

Appendix 2

Recommendations for Teacher Two

Future actions

The evaluation model suggested in **Diagram 4** showed that future actions recommended for Teacher Two could involve three main strategies. Firstly, the development of a teaching resource based on Teacher Two's vision of the possible application of computers to the teaching of colour and design principles. Such a resource would suit Teacher Two's interests and organisational requirements while expanding the range of computer projects she undertook with her class. Secondly, a strategy to help capitalise on the communication she had already established with visiting artists in the after school program and thirdly, a plan for upgrading and purchasing new equipment. Therefore, the following plan was suggested.

1. Extension of colour and design exercises.

By extending Teacher Two's original use of the computer for colour and design exercises, a stand-alone unit of activities for the classroom could be developed. The unit would take advantage of the computers' ability to create series of images and would represent a cost effective and time saving use of the available technology. Such a project might involve the following steps.

a) Review of the original activity.

The original design and colour exercise would need to be reviewed in order to identify its benefits and shortcomings.

b) Preparation of stand-alone worksheets.

Setting up worksheets for the previous exercise would enable students to complete the activity without the help of the teacher and create a stand-alone format to follow in future activities. It would also extend Teacher Two's personal use of the computer.

c) Collection of resource materials.

Collecting resource materials on colour and design activities such as books and posters would assist in the development of a range of activities. These activities could include explorations of design elements such as emphasis, balance, texture, line, movement or shape.

d) Framegrabbing starting points.

Arranging to have some design starting points framegrabbed at an outside facility could be a one-off investment in time that would greatly enrich the teaching resource. A selection of about twenty images could be used over and over again by students in a variety of ways. These images could include, for example, photographs of natural and human-made objects, interiors, landscapes or portraits.

e) Trialing the resource.

When developed, the group of exercises could be given a trial run with students of different age and ability levels. Problems could be noted and addressed before finalising the resource.

f) Writing a report.

Contributing a written account of the project to a publication such as that of the Queensland Art Teachers' Association could have many benefits. Firstly, it would provide professional recognition for the teacher and the school and secondly, it might promote an exchange of lesson ideas or resources between teachers.

2. Visiting artists

The contribution of visiting artists to the students at Teacher Two's school was a positive experience for the students involved and should be continued. Possibly some activities which could enable the reaping of more long term benefits from their visits could include the following.

a) Taped interviews with visitors.

Teacher Two could organise students to videotape an interview with each visiting artist for the Art room library. The artists could discuss their work, comment on issues related to art and technology and answer

questions about their educational background, career plans and other experiences. For the students involved, the video project would provide a learning experience in itself and would result in a bank of classroom resources featuring technology-based artists.

b) Recording of visitor's activities.

Another option for Teacher Two could be to have the visiting artist record the steps required to complete particular activities with students. These might prove a useful guide to students who wish to repeat the project in the classroom or may outline the processes involved for Teacher Two should she decide to attempt similar activities.

3. Resources purchasing plan.

A pressing problem for Teacher Two is deciding on a long term direction for technology use in her classroom in order to guide the future purchase of equipment or the upgrading of existing equipment. Lack of an input device and some more current software are two of the most notable drawbacks in Teacher Two's inventory.

These missing ingredients prevent the successful implementation of even the simplest activities. Therefore, it is recommended that consideration be given to this issue. Some suggestions follow.

a) Upgrade Amiga hardware and software.

The upgrading of the classroom Amiga equipment should include the purchase of an input device and the broadening of the available range of software to include more recent versions of paint programs and a desktop publishing program. It is unlikely in the beginning, that Teacher Two would be able to learn about or implement more than these two basic types of software. The unreliable supply and maintenance of Amiga equipment and the lack of support from the Computer Coordinator who is unfamiliar with the Amiga platform could work against the success of this approach.

b) Gaining access to a MacIntosh laboratory.

Gaining access to the school's MacIntosh laboratory could still require the upgrading of hardware and software and the purchase of an input device for the

laboratory. Timetabling arrangements may also prove inconvenient for Teacher Two. However, some advantages would include the support and advice of the computer coordinator and the increased profile of the arts department through the use of shared spaces. If this avenue was chosen, it would be advantageous for Teacher Two to aim at the purchase of at least one MacIntosh computer to be located in the art room so students could use the computer as part of the art process instead of as a separate laboratory experience.

Appendix 3

Recommendations for Teacher Three

Future actions

The fact that more than six months after the researcher's last visit, the multimedia authoring program, AmigaVision, had not been used again by the teacher or students highlights the problems involved in the transfer of skills from inservice experiences to the classroom. Lack of administrative support and difficulties with student access had also been noted as negative factors. A multimedia project based on Teacher Three's specialty area is therefore suggested to consolidate the skills already learned while at the same time exploring the use of the computer as an extension of traditional media and the purchase of non-computer resources is recommended.

1. A Multimedia project involving painting.

Two changes are suggested to the previous approach to multimedia use in Teacher Three's classroom. Firstly, the

project should involve Teacher Three's interest area - painting, and secondly, the project should remain within the one Art class and not be shared in the first instance among a multi-class group. The Art class selected for the project should include some of the students who showed responsibility and interest during the researcher's previous visits. These measures are designed to increase interest for the teacher and reduce organisational problems. The project would extend over a school term and involve the close integration of the computer with the creation of a major studio work in the area of painting. The steps required to create the project include the following.

a) Framegrabbing of developing art works.

Students should be organised to framegrab their work at different stages of its development throughout the term. The grabs could include starting points, preliminary sketches, rejected ideas, the work in various stages of progression and the final work.

b) Image editing, screen layout and text.

Each of the images grabbed by students will need to be edited, screen designed and have a text explanation added.

The computer may also be used as a diagnostic tool for interested students during the early stages of development.

c) Creating an AmigaVision sequence.

The AmigaVision project 'Animals in Art' created previously could be used as a shell for presenting student works. The animated introduction and conclusion might be replaced by a simple screen introducing the student's name and interests. The 'Animals in Art' screen designs would then be replaced by the new student works. Teacher Three could refer to the manual or the guidelines from the inservice workshop if needed.

d) Presentation of the final project.

The final project would include the developmental stages of a major painting by the participating students. It would provide an interesting record of the student work and may prove enlightening to future classes faced with the prospect of completing a major studio painting. A run time copy of the program could also be shared with other teachers in the region who use Amiga computers. It

should be noted that if Teacher Three intends all 30 students to participate in the project, extra memory may be required to store the images and run the program on the computer.

2. Purchase of non-computer resources.

Also recommended for Teacher Three is the purchase of non-computer resources for classroom use such as books, magazines and posters which feature computer artists and discuss art and technology issues. Such a strategy may provide stimulation for students working on the computer without the teacher's help and may also be useful for discussing art and technology issues usually overlooked during studio activities.

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